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SkyNews

JULY/AUGUST 2015

The Canadian Magazine of Astronomy & Stargazing

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BEST METEOR SHOWER OF THE YEAR: Where and When to Watch

+

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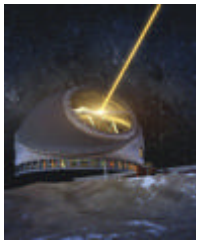

COVER: Illustration of the Thirty Meter Telescope when it is operational in 2023 atop Hawaii's Mauna Kea. The intense beam is from the guide-star laser, part of an adaptive optics system that will give the big telescope unprecedented capabilities. See Ivan Semeniuk's feature report beginning on page 11.

VISIT US AT SkyNews.ca

by Terence Dickinson

Planet Fest 2015

Venus and Jupiter brightened our spring sky, with Saturn remaining for summer.

IF YOU ARE READING THIS BEFORE JULY 1, mark your calendar as a reminder to be outside and looking west for the planetary conjunction of the year. Venus and Jupiter, the two brightest planets, will be strikingly close together in the evening sky at dusk on both June 30 and July 1. Because these two neighbour worlds are brighter than any stars, this is a rare head-turning celestial event.

Of course, Venus and Jupiter have been in the evening sky for months. Venus is the nearest planet to Earth and, consequently, appears to move more rapidly in its orbit than does more distant Jupiter. So from our point of view on Earth, Venus is passing Jupiter. Only rarely is planetary orbital motion as obvious as in late June and early July this year.

Back in late May and early June, Toronto-based amateur astronomer Jim Chung was busy imaging Venus and Jupiter, as well as Saturn later in the night. He reports that the images shown below were "taken with my 18-inch ultralight homebuilt Dobsonian Newtonian [Steve Swayze optics] on a motorized base."

The images were obtained at approximately f/20 with a Point Grey Research Grasshopper Express CCD running at 30 frames per second. The advantage of such rapid image acquisition is that split seconds of superb steadiness in the Earth's atmosphere are captured, then set aside. Only the "good seeing" images are digitally stacked for the final results seen here. Therefore, these portraits of the planets match those cherished moments of perfect seeing that planetary observers talk about at star parties.

Notice the disc of Io in front of Jupiter, for instance, as well as the intricate cloud detail on the giant planet. For 150 years, visual observers have reported telescopic fine detail as seen here, but it has been unpredictable and only momentary. Now 21st-century backyard astronomers (front yard, too, in this case) can record it for the rest of us to enjoy.

HEAVENLY TRIO From his front lawn in Toronto, Jim Chung used an 18-inch Newtonian for these portraits of the three planets in our sky this spring. An ultraviolet filter added colour and detail to the Venus image.
PHOTOS BY JIM CHUNG

SATURN THIS SUMMER

Jim Chung's Saturn image was taken this spring, so it shows the giant ringed world exactly as it will be seen this summer in your telescope. This reminds me of my very first look at Saturn, in 1958, through my 60mm refractor. That was three Saturn orbits ago, and the planet was in the constellation Scorpius, close to where we see it this year. That look was unforgettable: the planet with its rings appearing as a perfect minature of the pictures in my astronomy books. Of all the sights in astronomy, this is the one to share. From city or country sites, Saturn can be enjoyed in its full glory. Share it if you can, because very few people ever forget the experience.

DANCE OF THE JOVIAN MOONS

The upper image on page 6 is a rare capture of one moon of Jupiter partially eclipsing another. The brownish moon in the foreground is Ganymede; volcanic Io is the smaller, brighter, orange moon. Io is also seen on this page in front of Jupiter in the composite photo at left.

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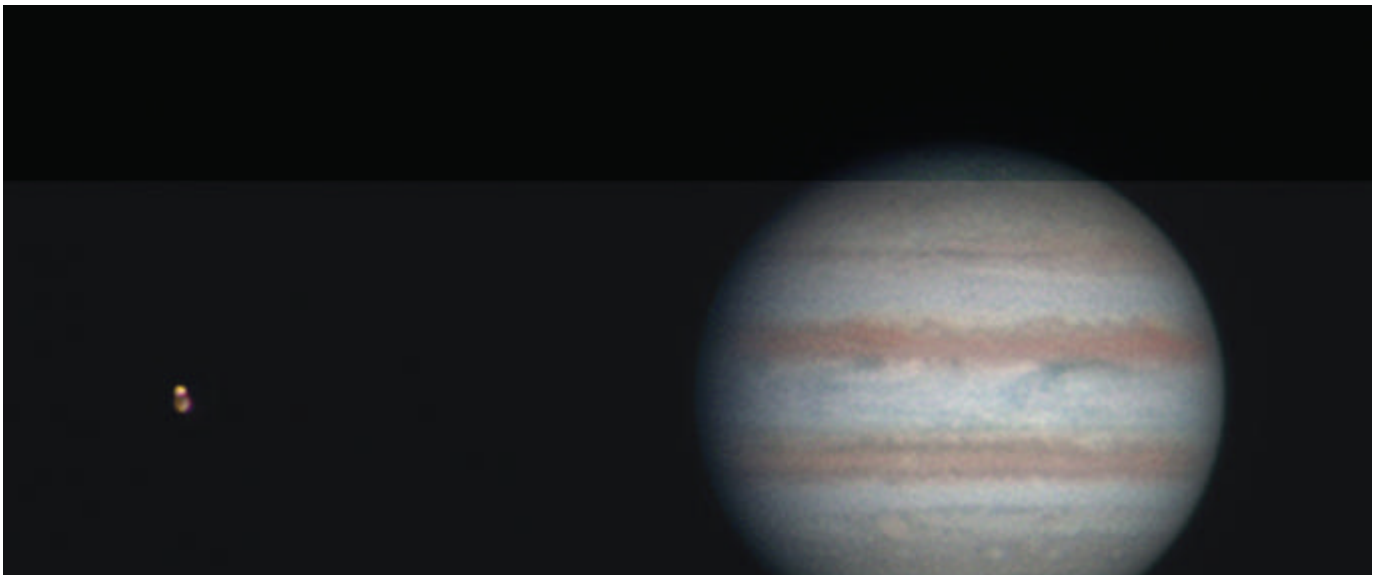

GANYMEDE PARTIALLY ECLIPSES IO For a few months every five to six years, the orbital plane of the four major Jovian satellites is edge-on to Earth. At these times, the moons can pass in front of one another. The most recent of these alignments occurred this past winter and spring. Here, we see Ganymede, the largest moon, as it partially eclipsed Io on April 28, as imaged by a Celestron 9.25-inch Schmidt-Cassegrain. PHOTO BY DANIEL BORCARD

DUNLAP OBSERVATORY This spring, Canada's largest telescope was officially donated to the Toronto Centre of The Royal Astronomical Society of Canada to operate and steward. PHOTO BY RANDY ATTWOOD

HIGH-PERFORMANCE LENS Sigma's "Art" Series lenses have caught the attention of astro-imagers. The latest lens (left), released this spring, is a 24mm f/1.4. PHOTO BY TERENCE DICKINSON

SIGMA DOES IT AGAIN

Many camera companies and lens manufacturers offer 24mm lenses for DSLR cameras. Most are perfectly capable for daytime and twilight imaging. But when it comes to the night sky, the toughest test for any lens is rendering star images as pinpoints across the full field of view. The problem is that stars and other point sources of light appear seagull-shaped toward the edge of the frame, and this aberration is devilishly difficult to reduce enough to give clean starry images. Utilizing moulded, aspherical lens elements and multiple low-dispersion glass, Sigma's "Art" Series 50mm and 35mm lenses achieve sharp stars between f/2 and f/2.5—a level that other lenses cannot match at these "fast" f-stops (*SkyNews*, November/December 2014, page 12).

I was keen to test the new 24mm lens in the Art Series to see whether Sigma could maintain this standard, as was our contributing astro-imager Lynn Hilborn. Take a look at his photo on page 16, which was taken with this lens at f/2.0. Not surprisingly, the lenses are priced in the range of $1,000+. If there are better-performing lenses in these focal lengths, I have not seen them.

DAVID DUNLAP OBSERVATORY

In 1935, the David Dunlap Observatory, housing a 74-inch telescope, was completed in Richmond Hill, Ontario. Today, the observatory sits within the Greater Toronto Area (population about five million). In the 21st century, having the largest astronomical observatory in Canada within a huge urban area became an increasingly non-viable proposition. In 2008, Corsica Development Inc. purchased the 190-acre property and observatory buildings from the University of Toronto.

This spring, Corsica announced that it was donating nearly 100 acres of the land to the Town of Richmond Hill. In addition, the Dunlap Observatory itself was donated to an agency that would honour the spirit of the observatory and ensure its long-term viability: the Toronto Centre of The Royal Astronomical Society of Canada (RASC). Members of the Toronto Centre have been managing and operating the observatory for the past six years.

"This is an incredibly generous gift," says Paul Mortfield, president of the RASC Toronto Centre. (For more information, visit: www.theDDO.ca.) ✦

Editor Terence Dickinson invites your comments and astronomy-related observations and photos, which can be directed to him at dickinsonSkyNews@gmail.com.

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PRECARIOUS SELFIE POSITION

A recent trip to dark skies on the Big Island of Hawaii serendipitously coincided with the peak magnitude of the nova in Sagittarius. Scouting out possible foreground locations during the day to get a shot of this nova, I found two potential sites. One was on a seaside cliff; the other was in the middle of a lava field.

After waiting four nights for the sky to clear, I awoke to my alarm at 2:30 a.m. Bleary-eyed, I loaded my gear and hiked to the first location. Upon arriving at the site, I realized it was now high tide, and the waves were coming within a metre of where I needed to set up my camera. I decided the possibility of a rogue wave made this site unsafe, so I hiked inland to my backup location. This took a bit of wandering, as I discovered that using dead reckoning to find one's way around a lava field at night is not the best method of navigation.

Eventually finding the site, I set up my gear (Canon 6D, Rokinon 12mm f/2.8 fisheye lens, tripod and Giga T Pro II remote trigger) and polar-aligned my AstroTrac mount. After taking a few trial shots, I scrambled into place to put myself in the photo. This involved climbing a 30-degree angled slab of lava and standing stock-still for the duration of the exposure. This was quite unnerving, since I found that with darkness all around, it is difficult to maintain your balance in a precarious position. Falling off my perch was not an option, as I would have sustained severe lacerations from the jagged lava.

I took several images until I was happy with the result. Before and after each shot, I had to climb up and down the sloped lava, a procedure done with great care. The final photo shown here is a single 3-minute exposure at ISO 1600 and f/4.

I've added a small arrow to the photo to indicate the nova's position, just above and to the right of the bright light source on the horizon. The sky transparency was quite poor due to haze from emissions associated with the actively erupting Kīlauea volcano, as well as mist from the nearby ocean. Thus despite the nova's being mid-fifth magnitude, I could not see it without binoculars.

Interestingly, while taking this photo, I occasionally heard whales surfacing a few hundred metres away and snorting through their blowholes, a new sound for me while stargazing.

Warren Findlay
Edmonton, Alberta

CONJUNCTION OVER THE CITY

Here's an image of a young crescent Moon beside Mars, with the pair stationed next to Toronto's CN Tower. This photo was taken in evening twilight on March 21 from the Toronto Port Lands with a Canon T2i and kit 18-55mm lens at 50mm for 2 seconds at f/5.6 and ISO 400.

Stuart McNair
Richmond Hill, Ontario

EDITOR'S NOTE: *Regarding our review of the Celestron NexStar Evolution 8 telescope in the May/June* SkyNews *and our statement about using the SkyQ app, Celestron has notified us of the following:*

"Shortly after the introduction of SkyPortal last year, the SkyQ app was no longer supported or available. SkyPortal was co-developed by the makers of SkySafari and Celestron to work with Celestron WiFi-compatible telescopes, including telescopes equipped with SkyQ Link 2 and the NexStar Evolution. The app is free and has undergone numerous improvements, with support for iOS and Android. SkyPortal may be upgraded to SkySafari Plus and SkySafari Pro to include a larger number of celestial objects to locate with a telescope."

SUBMITTING LETTERS AND PHOTOS

SkyNews *editor Terence Dickinson welcomes your letters about your astronomical observing activities and about anything you read in the magazine. Submission of photos as attachments is encouraged, as we publish many photos in each issue. Send photos in jpeg format, keeping compressed file size to less than 3MB, to: dickinsonSkyNews@gmail.com.*

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CANADA A PARTNER IN THE THIRTY METER TELESCOPE

One hundred years ago, Canada was in the race to build the world's largest telescope. A century later, Canada has stepped up to the plate again.

by Ivan Semeniuk

IT WAS A TIME OF TRANSITION, when the leading edge of professional astronomy was shifting decisively from the great refracting telescopes of the 19th century to a new generation of big reflectors, telescopes that use enormous mirrors to collect light from the distant universe. The Canadian government had approved a 72-inch instrument to be installed at the new Dominion Astrophysical Observatory (DAO) near Victoria, British Columbia. It would be larger than any telescope ever built.

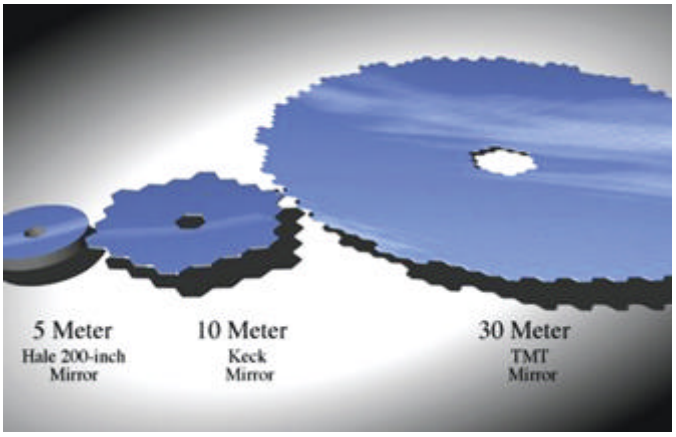
In the end, it missed holding that record by only six months. After a scratch was discovered on the telescope's enormous mirror, it had to be reground and then reground again. While it was delayed, it was overtaken by the 100-inch telescope on Mount Wilson, which would become famous for Edwin Hubble's observations of the galaxies. By the time the 72-inch saw first light in May 1918, it could no longer claim top spot. But the DAO had a formidable instrument all the same, one that allowed its director, John Plaskett, to discern the structure of the galaxy. Along the way, it would transform astronomy in Canada.

"When we built the DAO, that was certainly jumping into the front row," says Ray Carlberg, an astrophysicist at the University of Toronto. "It put us right at the frontier."

Now Canada is back at the frontier, says Carlberg. As Canadian director of the Thirty Meter Telescope (TMT), he was on hand when Prime Minister Stephen Harper committed $243.5 million, the equivalent of a 15 percent share, to the construction of the mammoth new observatory on Mauna Kea in Hawaii.

The development marks a watershed moment in Canadian astronomy, perhaps the most significant since the DAO was commissioned a century ago. Canada has already invested about $30 million in the design and development of the TMT. When completed (first light is projected for 2023), it will be one of only two or three supergiant optical telescopes in

HUGE STRUCTURE Comparing the size of the TMT dome with that of the Parliament Building in Ottawa reinforces the enormity of this project. A Canadian company, Dynamic Structures, is building the dome.



A BIG INCREASE IN APERTURE In 1949, when the 200-inch telescope on Palomar Mountain in California was completed and began gathering scientific images of celestial objects, it was by far the largest telescope in the world. Its nearest rival was the 100-inch Mount Wilson reflector. Today's largest scopes have mirrors in the 8- to 11- metre range, so the jump to 30 metres will be proportionally even greater. Larger aperture means seeing fainter objects and finer details. COURTESY UNIVERSITY OF CALIFORNIA

the world. Its capabilities will define the next era of big astronomy and serve an entire generation of researchers now coming of age in Canadian universities. Significantly, it will be available to astronomers at the same time as NASA's James Webb Space Telescope, another project in which Canada has a stake. Together, the two are expected to deliver a complementary capacity to spot interesting objects at the edge of the visible universe and follow up with more detailed ground-based study.

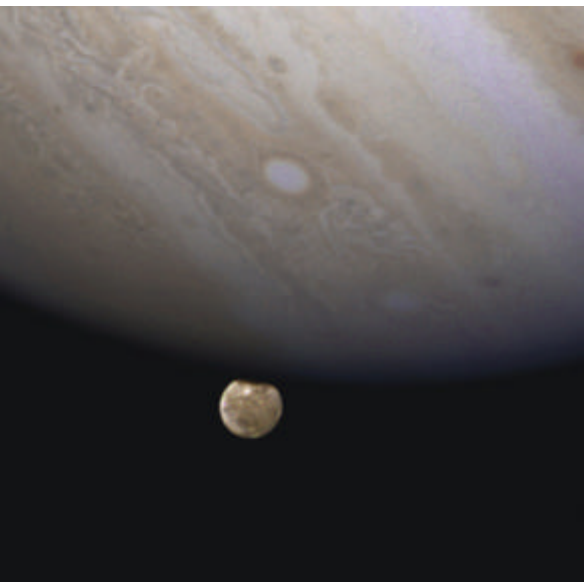
Canada's official entry comes just in time for the TMT. Last year, the California-based consortium that leads the project extended its deadline to give Canadian astronomers more time to muster support. Industry partners, university presidents and other stakeholders put their case before government decision-makers in a concerted effort that ultimately reached the Prime Minister's office last December. Clearly, a big selling feature is that a Canadian company, Dynamic Structures of Port Coquitlam, British Columbia, will be tasked with building the telescope's elegant calotte-style dome.

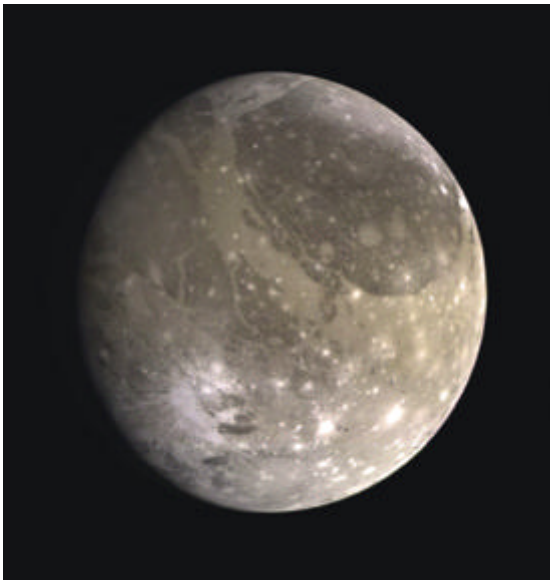
But alongside their arguments about the economic benefits and research competitiveness, astronomers added more aspirational appeals based on what the telescope will allow them to do.

For Ernie Seaquist, executive director of the Association of Canadian Universities for Research in Astronomy and a frequent participant in closed-door meetings with federal officials, that meant boiling down the broad scientific potential of the TMT into one well-honed line: "I simply said, 'How would Canada like to have the credit for hosting the discovery of the first planet to show signs of supporting life?' "

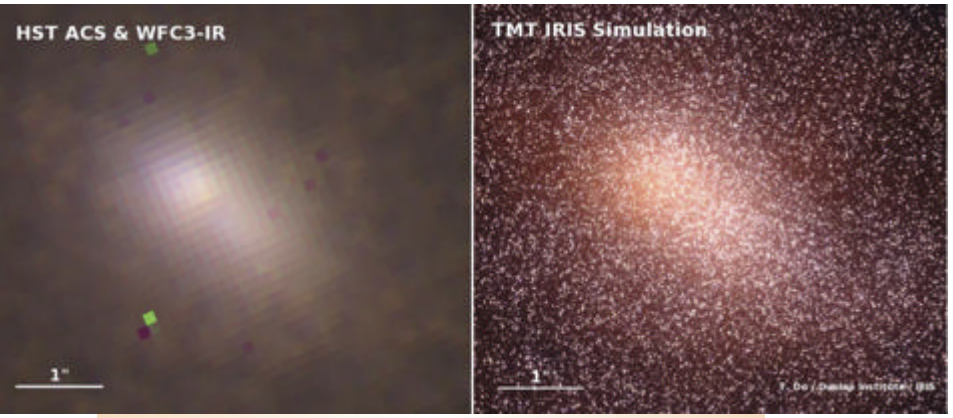
The scenario is not overstated. The TMT's primary mirror, comprising 492 hexagonal segments, will have 14 times the light-collecting area of either of the 8-metre Gemini telescopes—the largest to which Canada currently has national access. When augmented by a Canadian-built adaptive optics system designed to correct for atmospheric distortion and to concentrate faint bundles of incoming light as tightly as possible, the TMT should offer about a 200-fold improvement over today's largest telescopes in terms of sheer resolving power.

When trained on a distant solar system, the TMT will be able to probe much closer to the central star and spot planets that are 100 million to one billion times fainter. The spectroscopic analysis





TMT VS. HST Currently, our best view of celestial objects from the Earth's vicinity is provided by the 2.4-metre Hubble Space Telescope (HST), which reveals details on Jupiter's largest moon Ganymede (far left). When the full power of the TMT and its narrow-field infrared adaptive optics system (see box, facing page) is unleashed in the mid-2020s, it should produce images of Ganymede similar to the one (left) that was obtained by Voyager 2 as it swept past Jupiter 35 years ago. Similar results are expected on a wide range of astronomical targets. COURTESY NASA (BOTH)



STELLAR PERFORMANCE The power of the TMT is illustrated in this view of a small galaxy as seen by the Hubble Space Telescope (far left) and a simulation of the same galaxy imaged by the TMT (left). This is where the true power of the TMT comes into play. Detecting faint detail means ultimately seeing the origins of stars and galaxies billions of light-years distant.

of that reflected planetary light could conceivably reveal whether the planet's atmosphere is water-rich, sustains vegetation or, based on some recent studies, shows traces of industrial pollution.

"When I think that this is the telescope we're building, it just blows my mind," says Luc Simard, instrument group leader for the TMT and an astronomer with the National Research Council, based at the DAO.

Spectroscopy will clearly be an important part of what the TMT can do. Aside from spying on exoplanets, it will be used to look to the farthest extent of the visible universe, picking up light that has been travelling toward us since the first stars turned on, less than a billion years after the Big Bang. Those stars could be quite different, chemically speaking, from later generations, including stars like the Sun. The TMT may be able to tease out those differences if they are written in the spectra of the most distant objects it observes.

The boost in resolution that the TMT offers will also revolutionize astronomical imaging in ways which will likely astonish, says Simard. As an example, he points out that the telescope will see sharply enough to map the surfaces of about 800 objects in the main asteroid belt, as well as reveal the moons of the outer planets, Pluto and the vast population of icy bodies in the Kuiper belt—something no existing ground-based telescope could ever hope to do today.

Looking out into the Milky Way, the TMT's pinpoint gaze should record the slight motions of the stars as they shift in relation to one another, turning our "frozen" impression of the night sky into something that resembles a slow-motion movie. Even the Andromeda Galaxy, more than two million light-years distant, will be seen as an aggregation of objects in motion, rather than a static system. At the centre of our own galaxy, the TMT should be able to measure the movement of stars with enough precision to check for subtle space-twisting effects caused by the rotation of the Milky Way's central giant black hole.

And then there are the possibilities that no one has thought of yet, says Carlberg, simply because the TMT will be able to accelerate the pace of discovery. "There's a lot of opportunity for making observations that have never been done before."

There is a long way to go, and uncertainties remain. With Canada's help, the TMT now has approximately 80 percent of the funding required. That is enough to move forward, but one or more additional partners may be needed to achieve the observatory's full potential. So far, Canada joins California, Japan, China and India. In the near term, protests from native Hawaiian activists have delayed construction activities at the Mauna Kea site. Meanwhile, the TMT's chief competitor, the even larger 39-metre European Extremely Large Telescope, is inching toward first light in 2024.

But however the journey unfolds, Canadian astronomers are now assured that they'll be along for the ride. ✦

Ivan Semeniuk is a science reporter for The Globe and Mail *newspaper and website. His columns appear regularly in* SkyNews.

TMT: THE BACK END

With a primary mirror that would easily cover two tennis courts, the TMT is designed to access the universe with unprecedented sensitivity. But while a large collecting surface is a necessary starting point for any next-generation telescope, it's the optical system behind the mirror that will ultimately determine the level of science the telescope can achieve.

Today's cutting-edge astronomical instruments are typically the size of small cars bolted onto their 8- and 10-metre telescopes. On the TMT, the instruments will be the size of entire buildings. Rather than work *on* them, optical engineers will work *in* them. Each will cost tens of millions of dollars to develop and construct.

The TMT is designed to host up to eight such instruments, with a combined weight of 240 tonnes. But for initial operations, the TMT partnership has selected four key detectors that astronomers will have access to when the telescope achieves first light:

NARROW-FIELD INFRARED ADAPTIVE OPTICS SYSTEM (NFIRAOS): This Canadian-built system will take incoming light from the telescope and employ two deformable mirrors with a high-speed computing system capable of making thousands of separate adjustments hundreds of times per second, all aimed to compensate for the distortions caused by the Earth's constantly changing atmosphere.

INFRARED IMAGER AND SPECTROMETER (IRIS): Billed as the most sensitive astronomical instrument ever designed, IRIS will be tied to the Narrow-Field Infrared Adaptive Optics System to take ultrasharp images with a resolution about 12 times that of the Hubble Space Telescope.

INFRARED MULTI-SLIT SPECTROMETER (IRMS): Operating in the near infrared, this instrument is a modified version of a detector that has been in use on the Keck telescopes since 2012. It will work in tandem with the Narrow-Field Infrared Adaptive Optics System and, among other tasks, will look for telltale spectral lines that can reveal the presence of primordial stars at the far edge of the universe.

WIDE-FIELD OPTICAL SPECTROMETER (WFOS): The only first-light instrument meant to operate independently of the Narrow-Field Infrared Adaptive Optics System, WFOS will work at optical wavelengths and will be able to observe hundreds of objects at the same time, gathering a unique spectrum from each. WFOS will be ideal for measuring chemical compositions across an entire field of stars or galaxies as well as Doppler shifts that can reveal relative motions or distances.

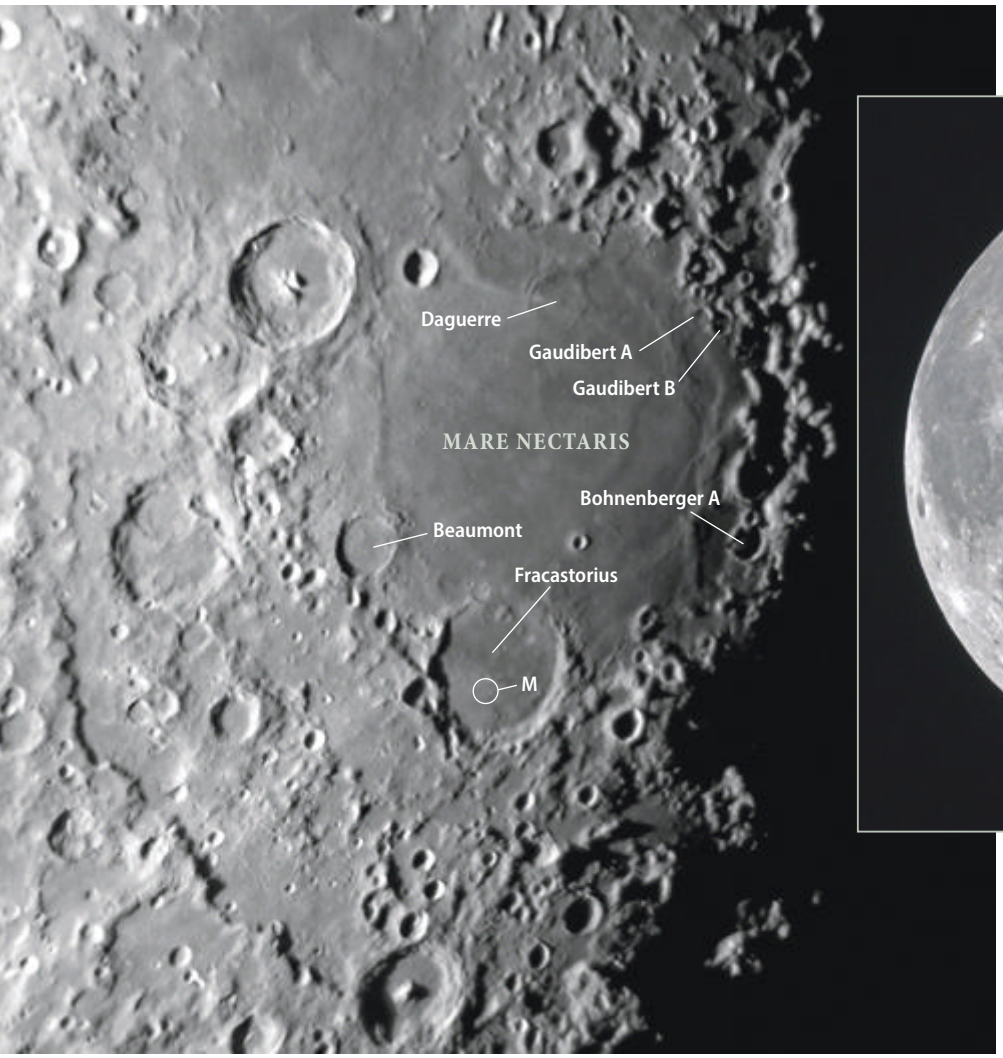
by Gary Seronik

Ghost Craters of Nectaris

Sometimes even big craters can be surprisingly inconspicuous. You can see several fascinating examples on Mare Nectaris.

THE BEST-PRESERVED IMPACT BASIN on the near side of the Moon is Nectaris. If you look carefully, you can trace parts of several rims, but the most conspicuous part is the 333-kilometre-wide mare that fills the main depression. Along the southern shore of Mare Nectaris is Fracastorius, a curious 112-kilometre-wide crater with much of its northern rim buried under Nectaris lavas. How did that happen? After the Nectaris basin formed, a second lesser impact formed Fracastorius. Eventually, lavas welled up inside Nectaris, and their sheer weight made the centre of the basin sink a little, causing Fracastorius to tilt slightly. As a result, the crater's northern wall became low enough for rising lavas to flow in, burying the northern rim of Fracastorius and flooding its floor.

It's a fascinating story to keep in mind as you examine Fracastorius in a telescope. Where its northern rim should be, you will see some jumbled mounds that suggest a rough curve. Also apparent are a few small craters on the mostly smooth floor of Fracastorius. These are relatively recent additions. The largest craterlets are Fracastorius L and M, which are only five and four kilometres across, respectively. The southernmost of the two (Fracastorius M) is situated on the south edge, near the middle of a roughly east-west trending rille. This narrow linear feature spans the full width of Fracastorius but is less than one kilometre



THE WANING GIBBOUS MOON
Ghost craters abound along the shoreline of Mare Nectaris. The largest and most interesting is Fracastorius, which features a thin rille and several small craterlets. PHOTOS BY GARY SERONIK

wide for most of its length. Can you detect it? You'll need moderately high magnification and good seeing conditions.

I looked for the rille in my 6-inch reflector but was never able to convince myself that I could see it. Viewing on the same evening, fellow *SkyNews* contributor Ken Hewitt-White had better luck while examining the feature with his 10-inch Dobsonian. "I fleetingly traced a thin white line extending from Fracastorius M to the main crater's west wall," he reports. "However, I saw nothing on the opposite side." (Remember that east and west on the Moon are the reverse of sky directions.)

The effects of Nectaris lava flooding aren't unique to Fracastorius.This fate befell several other craters. Northwest of Fracastorius is 53-kilometre-wide Beaumont, which looks like a smaller version of its big-brother neighbour. The main difference is that Beaumont's floor isn't nearly as smooth. And if you proceed clockwise around the shore of Nectaris, you'll find several other ghostly craters, including the twins Gaudibert A and B (each 21 kilometres in diameter) and 30-kilometre-wide Bohnenberger A.

Perhaps the most ghostly Nectaris crater of them all is 46-kilometre-wide Daguerre. It's nearly not there at all. You have to look when the terminator is positioned nearby and the crater's circular form is most obvious. But "obvious" isn't the right descriptor even when the lighting conditions are ideal. Most of Daguerre's rim rises only 100 metres or so above the mare floor, and its southern edge is completely absent. No wonder the crater is so difficult to identify.

At this time of year, it's best to view the Nectaris region when the Moon is a waning 19-day-old gibbous and is relatively high in the sky. You can also catch Nectaris when the lunar disc is a waxing crescent, but during the summer, that phase rides low on the ecliptic, where seeing conditions are often unfavourable. ✦

A veteran lunar observer, Gary Seronik is the editor of Antonín Rükl's classic Atlas of the Moon *and Charles A Wood's* The Modern Moon. *He is also editor of this magazine's website, SkyNews.ca.*

CELESTIAL SCENERY

This selection of readers' astro-images highlights heavenly views from near home to a portrait of a total solar eclipse from an extremely remote site

BRIDGE BETWEEN THE STARS
This tranquil setting was captured after dusk in Nawautin Nature Sanctuary, near Grafton, Ontario, by astro-imager Lynn Hilborn, who lives nearby. Using the newly released Sigma 24mm f/1.4 "Art" Series lens at f/2.0, Hilborn recorded the scene with a single 20-second exposure at ISO 1600 on a tripod-mounted Canon 6D DSLR camera. Scorpius is at right, while Sagittarius is at left.

▲ **SAGITTARIUS NOVA HIDING IN PLAIN SIGHT** The brightest nova in two years was discovered on March 15 and reached a maximum brightness of magnitude 4.5 in April. It was magnitude 5 in central Sagittarius (see crosshairs at lower left) when this image was taken on March 29 by Malcolm Park near Bloomfield, Ontario. Scorpius is at right; Sagittarius is at lower left. A softening filter was used to enhance the stars.

▲ **TOTAL ECLIPSE OF THE SUN** Don Hladiuk of Calgary has chased 15 total solar eclipses since his first one in 1979. On the morning of March 20, he viewed this eclipse from a windy hill in the Faroe Islands, north of Scotland. He used a DSLR with a 400mm telephoto lens mounted on a heavy tripod low to the ground. "I raised the ISO to 10,000," he says, "allowing me to shoot with a high shutter speed." The clouds were low and moving fast, but a hole in the cloud deck opened for this ethereal shot of the "diamond ring" at the beginning of totality.

▲ **APRIL 19 ULTRATHIN CRESCENT MOON** A thin crescent Moon just before sunset can be a tough photo-imaging target, but add its reflection in calm water, and the scene becomes a rare catch. Stan Cholak of Andrew, Alberta, used a Nikon D800 with a 400mm f/5 telephoto lens for this 1/6-second exposure at ISO 800.

▲ **ALBERTA AURORA** A colourful display of northern lights on April 16 was widely visible from western Canada. This shot by Katie Barron shows Alberta's Mount Yamnuska (a.k.a. Mount John Laurie) silhouetted by auroral curtains. A Nikon D5100 DSLR with an 18mm lens was used at ISO 4000 for the 13-second exposure at f/3.5. Today's DSLR cameras allow previously unthinkable speeds of ISO 6400 or more for shots like this.

by Peter McMahon

Canada's Star Stories

Forget the ancient Greeks for a bit…there's a sky full of constellations from this *land*

EVERY TIME I SET OUT TO EXPLORE the heavens over Canada's 20+ dark sky preserves and other protected areas, I think about what makes each of these cosmic oases unique. In some, it's the chance to see the stars above iconic landscapes, from mountains and salt flats to waterfalls and tidal archways. In others, it's that I can see things in the night sky—due to darkness or geographical location—that are not visible from anywhere else in Canada.

CARIBOU, BEAVERS AND A GOOSE Long before Europeans brought Greek mythology to North America, true Canadian starry configurations populated the night sky.

But in many of these wilderness-astronomy destinations, it's the distinctly Canadian star lore that spans from sea to sea. While the constellations with which we are most familiar showcase dragons, queens, lions and other beings from Greek mythology, there's a whole cast of characters from *this* land: loons, bison, canoes and even a Sasquatch.

NEWFOUNDLAND'S VIKING ASTRONOMERS AND THE 'TROLLING MOON'

One thousand years after the Vikings dropped by this corner of North America, using tar-marked prisms called sunstones to help them navigate, an interesting piece of night-sky lore unique to the area remains. Local astro-guru Garry Dymond of the St. John's Centre of The Royal Astronomical Society of Canada tells how early fishermen who became permanent settlers in this region made reference to a "trolling Moon" when the boatlike crescent of our natural satellite seemed to be towing the "fishing tackle" of the planet Venus behind it.

SKY LOONS AND PADDLING THROUGH THE MILKY WAY

In the diamond shape formed by four stars in the constellation known to the ancient Greeks as Delphinus the dolphin, the Ojibwa First Nations of Ontario and Manitoba see a loon. Extending from the four stars of the body of the loon (Maung Anungonse in Ojibwa; Mokwachak to the Cree), a fifth star forms the bird's neck, making it look as if it's dipping its head into the water to fish for food.

Closer to the north celestial pole, the Oji-Cree of Ontario and central Canada see a great canoe paddling through the star trails of our galaxy. This constellation within a constellation has two parts: a bow

paddler at the front of the canoe, which is represented by the nail star, or North Star, and Oda-ka-daun, the stern paddler (sometimes seen as the Pleiades star cluster above Orion) at the back of the canoe.

The constellation the ancient Greeks called Orion is known to both the Cree and the Ojibwa as Wisakedjak, a teacher and also a mischievous trickster and shape-shifter. At times, they say, he takes the form of a furry giant, who some elders joke could make him the Bigfoot or Sasquatch constellation.

According to the Plains Cree, Maskote Pisike the bison, known to the ancient Greeks as Perseus, comes to Earth in the spring to walk the land, feeding and helping the First Nations of the Great Plains. During the hot nights of summer, part of the bison disappears, hidden where the ground meets the sky.

In a Blackfoot legend from the North American Plains, six children who felt neglected by their parents went up to the sky to become the Six Lost Boys, better known in Greek sky lore as the Pleiades.

A CELESTIAL CARIBOU IN THE INUIT SKY

Inuit have some of the most detailed constellation records on Earth, covering almost every bright star in their sky. Included among their stories is the constellation Tukturjuk the caribou, comprising the stars of the Big Dipper. Some Inuit see the handle of the stars of the Dipper as the head and antlers of Tukturjuk, while others see the seven stars of the Dipper as a whole herd of caribou. ✦

Peter McMahon's kids' book on the indigenous constellations of North America will be released in 2016 by Owlkids Books. For a downloadable version of Peter's First Nations star chart and more star stories from across Canada, go to wildernessastronomy.com and click on the "Magazine" link.

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SEE THE UNIVERSE LIVE AND IN COLOUR WITH

MALLINCAM

The MallinCam UNIVERSE

represents years of design and research in a colour CCD camera that is capable of live constant refresh with a maximum download of one second per frame. The new Constant Refresh System (CRS) is a first in a CCD camera, in which the CRS software downloads a live image for full-frame review on your computer monitor. The camera acts as a video system, displaying a non-stop new image at every exposure.

The MallinCam UNIVERSE is 100% USB 2.0 controlled, and the image is also transferred through USB. A deep-cooling system with a sealed sensor chamber allows cooling to reach –45°C to ensure the lowest noise and dark current where, in most cases, a dark frame is not generally required. **A first in the industry.** Taking publication-quality images is now possible and easier than ever with this new system. A constant live image is displayed for those who wish to use the camera as a live observing system. With its super-large sensor, its total optical diagonal size of 28.4mm across and its large pixel size of 7.8 x 7.8 microns, the camera excels in delivering live colour images. The CCD sensor has a total of 6.31 mega-pixels. The sensor's horizontal size is 25.10mm, and its vertical size is 17.64mm. The active pixels (6.11 mp) deliver a total size of 3032 x 2016. The New MallinCam UNIVERSE can also be switched from colour mode to black and white with a click of the mouse.

Live processing is done on the fly using features such as full histogram adjustment, full gamma range, full contrast range and auto white balance or manual RGB colour balance.

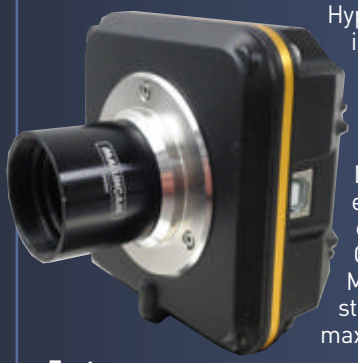
The unique "Hyper Circuit" found on all other MallinCam systems has been incorporated into this new design, allowing the MallinCam UNIVERSE to deliver a total variable gain of 26.06+ db, a dynamic range of 80 db and a signal-to-noise ratio of 60 db.

The MallinCam UNIVERSE comes complete with a 5-metre USB cable; a 2" threaded adapter; a 1.25" converter, allowing the use of an optional 1.25" eyepiece adapter; 110 volts AC to 12 volts DC power supply; driver; and software CD-ROM.

NEW! The MallinCam SkyRaider DeepSky Series

After years of designing and testing under all operative conditions, MallinCam presents the next generation of astronomical video CCD cameras. As well as live observation, the SkyRaider DeepSky Series can take images and video recordings. No one else has developed such a state-of-the-art astronomical camera. We are the leader in the live astronomical video CCD camera industry and plan to stay in the forefront for the amateur and professional astronomer alike.

Our software package features the most advanced live video-imaging system available. We have created our world-first software with the MallinCam DarkField Subtraction System On-The-Fly, eliminating the need of a Peltier cooler for live applications yet retaining the best low-noise live images on the market today. A MallinCam advanced exclusive, the DarkField Subtraction System is unique to the SkyRaider-DS Series. Images can be saved in the same manner, and video files can be created with the same On-The-Fly DarkField correction. A live On-The-Fly histogram makes final image adjustment possible, producing the finest live images, which can be saved as images or as a live video file. The MallinCam SkyRaider-DS Series features the world-renowned Hyper Circuit with a buffered variable gain, allowing you to increase sensitivity with low noise without increasing exposure—a MallinCam exclusive. The Hyper Circuit uses a triple-buffered electronic section to keep noise to a low level and can be used with the live DarkField Subtraction System for even lower noise. The SkyRaider-DS Series has dual independent onboard memories, ensuring separate video/imaging signal/data from the camera control through USB2 demand. No other video CCD camera system has these exciting features. The MallinCam SkyRaider-DS Series uses a unique two-stage step-up voltage driver to operate the CCD sensor to its maximum sensitivity at 15.3 volts from a 5-volt source.



Features:

- Handcrafted in Canada
- PC Win XP, Win 7, Win 8, Win 10, Mac OS X, Linux compatible
- Up to two hours' exposure (you'll never need that long!)
- Hyper Circuit with buffered variable gain for greater low-noise sensitivity
- Two-stage voltage step-up to ensure full CCD sensor sensitivity
- Dual independent memories for image/camera control
- 5-metre (15 feet) USB2 cable included
- 1.25" C-mount eyepiece adapter included
- Zing aluminum alloy construction for unmatched durability
- Sealed multicoated optical window with 350nm to 950nm range
- Grade 1 industrial electronic components throughout
- 5 volts USB operation at low 250ma current draw
- 13.30 ounces (377 grams)
- Exclusive On-The-Fly DarkField correction
- Full live-video mode, full-screen selectable
- Full imaging capabilities
- 12 bits for seamless fast download live-video observation
- Available with colour CCD sensor (SkyRaider-DSc) or monochrome CCD sensor (SkyRaider-DSm)

Intro price: $699.99
After August 31, 2015: $749.99

The MallinCam VRC12T

After a long wait, MallinCam has received its first batch of VRC12T (Video Ritchey-Chrétien) 12" optical truss tubes. At 52.8 pounds, including the supplied dual-speed focuser, this work of art is truly within the reach of the most discriminating live-video CCD observer, videographer and CCD astrophotographer. At f/8, it provides an excellent imaging platform for any DSLR, cooled CCD imager and astronomical camera.

Features:

- 12" aperture.
- Centre spotted quartz secondary mirror with 99% reflectivity non-tarnishing multi-layer dielectric mirror coatings.
- Low thermal expansion quartz primary mirror with 99% reflectivity non-tarnishing multi-layer dielectric mirror coatings.
- Three built-in cooling fans in rear cell.
- 2" dual-speed Crayford focuser with 1.25" adapter.
- Carbon fibre with Serrurier truss-tube design with CNC-machined stainless steel and aluminum components.
- Two large D-type "Losmandy" dovetails on top and bottom.
- Comes with three sets of spacer rings to achieve perfect focus with any imaging camera.
- 2432mm focal length f/8.

VRC12T* Retail: $4999.99
MALLINCAM Intro Price: $3999.99

VRC16T* Retail: $6999.99
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VRC10CF Retail: $2999.99**
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VRC8CF Retail: $1499.99**
MALLINCAM Intro Price: $1399.99

VRC6M* Retail: $699.00**
MALLINCAM Intro Price: $499.99

Applicable tax and shipping not included

*** "T" denotes truss-tube design**
**** "CF" denotes carbon-fibre tube**
***** "M" denotes metal tube**

NEW! The MallinCam XTERMINATOR

The MallinCam Xterminator is the finest, most advanced video CCD camera ever created for astronomical work by anyone. It has a new 14-bit DSP processor, dual preamps and dual bias algorithm, allowing continuous automatic adjustment of the CCD sensor regardless of the exposure. It also has the latest ICX823 EXview HAD II CCD ceramic sensor (CirDIP), available in Class 1 astronomical grade and Class 0 grade as an option. The new A/D converter to DSP has been reconfigured to deliver the cleanest image ever seen in a live video CCD camera, even with short exposure times.

Features:

- Sealed CCD chamber with 1/4" optical multi-coated glass.
- High-grade argon-gas-filled sensor chamber.
- New ICX828 EXview HAD II series ceramic (Cer DIP) sensor.
- Large 1/2" Micro Lens Technology CCD sensor.
- Anti-dew coatings on the CCD sensor and internal optical window (a MallinCam exclusive).
- New Holtek dual preamps configuration for greater gain (a MallinCam exclusive).
- New 14-bit DSP.
- New A/D converter configuration at the DSP (a MallinCam exclusive).
- Correlated double sampling (a MallinCam exclusive).
- Good suppression of CCD output low-frequency noise is achieved through the use of S/H-type correlated double sampling.
- A high S/N ratio is achieved through the use of an AGC-type dual amplifier, and high sensitivity is provided by a wide cover range (a MallinCam exclusive).
- An auto offset circuit provides compensation of output DC offset voltage fluctuations due to variations in AGC amplifier gain.
- New dual bias control for perfect control of the CCD sensor (a MallinCam exclusive).

* Cooling selection: OFF (idle), –5°C, –20°C via software.

All MallinCam products are handcrafted one at a time, making MallinCam the highest-performance CCD camera available in its class and the most-desired astronomical observational video system.

MallinCam.com

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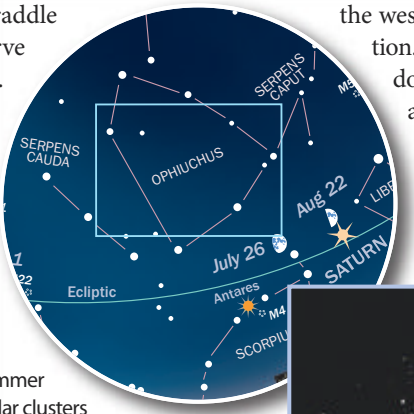
MESSIERS ACROSS THE MIDRIFF

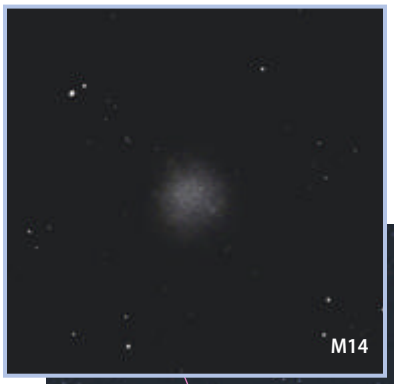
Four globulars—three of them Messier objects—lie near the middle of Ophiuchus. While the clusters aren't spectacular, each one is pleasingly different. by Ken Hewitt-White

WITH SO MANY SHOWPIECE STAR CLUSTERS visible at this time of year, it's easy to overlook the lesser-known globulars of Ophiuchus. The two best Ophiuchan globulars (plus two others) straddle the torso of the burly serpent-holder. Last summer, I decided to observe all four objects at the Mt. Kobau Star Party in southern British Columbia. The evening I set aside for the project was cloud-free. Perfect, right?

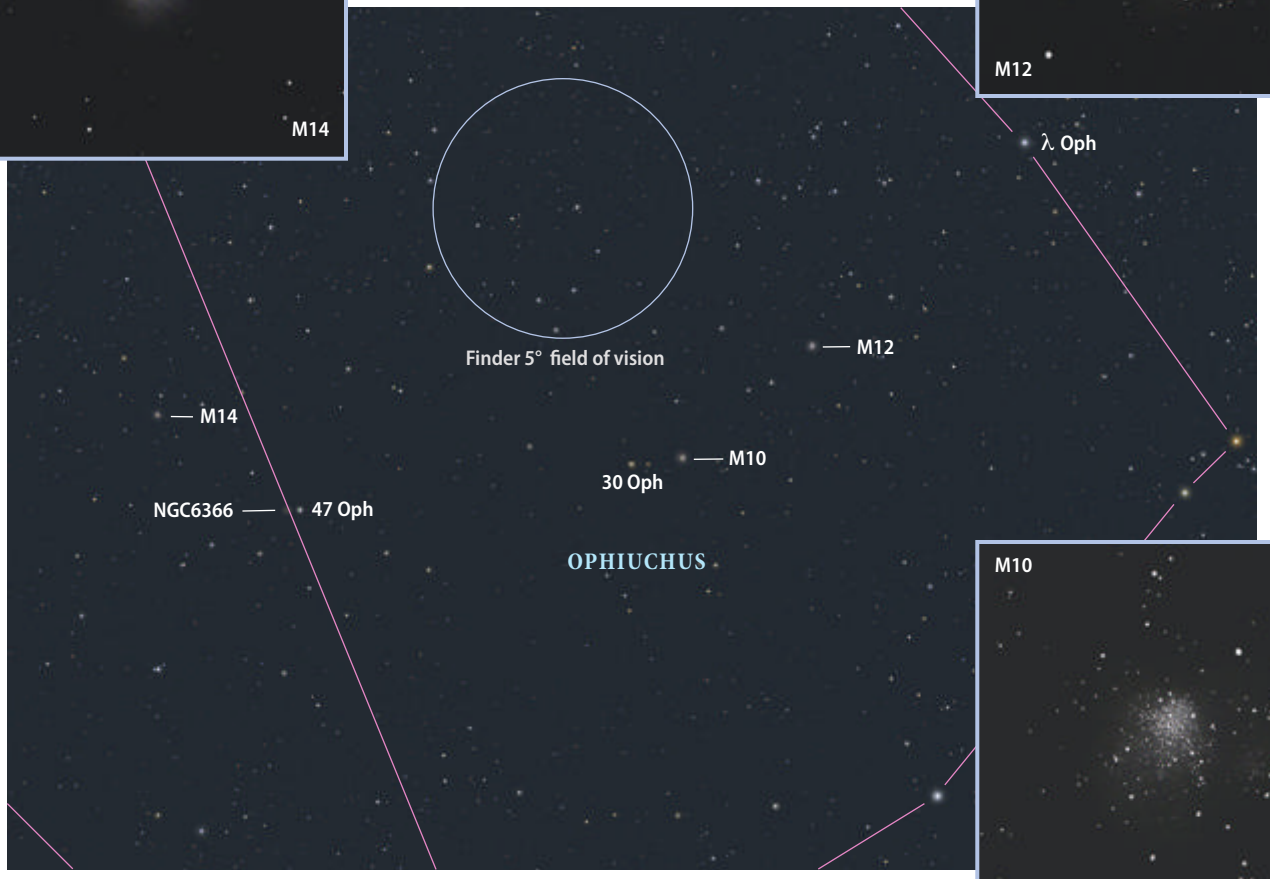
Wrong. Smoke wafting northward from a Washington State forest fire invaded our pristine sky after sunset. By the time the murk subsided, it was midnight and my targets had slipped to within 30 degrees of the horizon. There wasn't a moment to lose. I set to work with my 10-inch f/5.5 Dobsonian, limiting myself to one low-power (58x) and one high-power (200x) ocular.

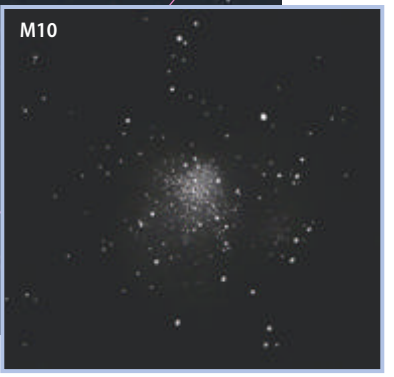
My route to the clusters began at fourth-magnitude lambda (λ) Ophiuchi, on the west side of the constellation. (Double-star aficionados take note: Lambda is a binary star comprising 4.2- and 5.2-magnitude components 1.6 arc seconds apart.) I shifted the telescope





OPHIUCHUS GLOBULARS In the apparently "empty" region of the summer constellation Ophiuchus, four globular clusters offer interesting comparisons for backyard telescopes. These sketches of three of them by John Karlsson were made at the eyepiece of a 15-inch Newtonian and are useful guides for users of smaller telescopes. CHART BELOW BY GLENN LEDREW





southeastward for six degrees, at which point my 8x50 finderscope swept up an out-of-focus "star." It was **Messier 12**.

M12 glows at magnitude 6.8 and is 14 arc minutes in diameter. The view at 58x produced what I'd expected: an obvious fuzzball partially resolved into faint pinpoints around the edge. A 10th-magnitude star shone close by to the southeast. The 200x image surprised me, though. Most of the brightest cluster members, perhaps a dozen 12th-magnitude stars, were scattered around the outskirts, while the middle of the globular was dimmer and grainy. This unusual profile—bright at the edge, not the centre—wasn't the only oddity. Protruding from the south side of M12 were several tenuous filaments, each several arc minutes long, that were reminiscent of auroral rays. Quickly, I asked my neighbouring Kobau comrade Lee Johnson to aim his 17.5-inch Dobsonian at M12. Working at 118x, Lee's big light-bucket confirmed that the aurora-like filaments were streamers of stars.

Four degrees southeast of M12, my finder caught the fifth-magnitude star 30 Ophiuchi along with **Messier 10** one degree to the west. M10 is slightly bigger (15 arc minutes) and brighter (magnitude 6.6) than M12. The view at low power was enticing: a diffuse ball, partially resolved, denser and brighter toward the middle. The 200x view revealed numerous 12th- and 13th-magnitude stars sprinkled over a spherical mist of extremely faint stars—a classic globular. Or maybe not. With longer scrutiny, a subtle asymmetry emerged. The east side of the cluster boasted a greater number of resolved stars than the west side. The richer eastern half faded gradually and uniformly into the sky, while the western half faded somewhat abruptly. An illusion? Stare at M10 and decide for yourself.

Seven degrees southeast of M10 is 4.5-magnitude 47 Ophiuchi. Barely ¼ degree east of that star is **NGC6366**. This cluster glows three magnitudes fainter than M10 and contains no stars brighter than magnitude 13.5. The result is a ghostly globular that's hard to see in the glare of 47 Ophiuchi. However, I noticed something east of 47 in the low-power eyepiece: a miniature "hockey stick" formed by four 10th- to 12th-magnitude stars, plus a fuzzy "puck" nearby. That puck was the prize. Although officially 13 arc minutes wide, NGC6366 appeared much smaller. Even at high magnification, I glimpsed only a grainy smudge.

Finally, I pushed three degrees northeastward to **Messier 14**, a globular that is two magnitudes brighter, visibly larger and more densely packed than NGC6366. Ah, but the leading members of M14 are dim, at magnitude 14, offering just a pale, slightly elliptical haze. At 200x, the haze exhibited a granular texture, and my averted vision picked up numerous faint pinpricks around the smooth periphery. Itching for a better view, I turned again to my friend's 17.5-inch Dobsonian. At 118x, I beheld a delicately resolved globular sporting a broadly luminous middle. Not bad! ✦

STAR CHART *for Summer*

OUR CHART SHOWS the major stars, planets and constellations visible from Canada and the northern United States within one hour of these times:

EARLY JULY: 11:30 P.M.; LATE JULY: 10:30 P.M.
EARLY AUGUST: 9:30 P.M.; LATE AUGUST: DUSK

THE EDGE OF THE CHART represents the horizon; the overhead point is at centre. On a moonless night in the country, you will see more stars than are shown here; deep in the city, you will see fewer. The ecliptic is the celestial pathway of the Moon and planets. The star groups straddling this line are known as the zodiac constellations. The Moon is shown for selected dates.

USING THE STAR CHART OUTDOORS: The chart is most effective when you use about one-quarter of it at a time, which roughly equals a comfortable field of view in a given direction. Outdoors, match the horizon compass direction on the chart with the actual direction you are facing. Don't be confused by the east and west points on the chart lying opposite their location on a map of the Earth. When the chart is held up to match the sky, with the direction you are facing at the bottom, the chart directions match the compass points. For best results when reading the chart outdoors, use a small flashlight heavily dimmed with red plastic or layers of brown paper. Unfiltered lights greatly reduce night-vision sensitivity.

CELESTIAL CALENDAR

JULY 1 Venus and Jupiter just 40 arc minutes apart in evening sky; full Moon, 10:20 p.m., EDT

JULY 6 Pluto at opposition; Earth farthest from Sun for 2015 (152,093,481 km)

JULY 8 Last-quarter Moon

JULY 9 Venus at greatest brilliancy (magnitude –4.7)

JULY 12 Waning crescent Moon 3° from Aldebaran and near Hyades in dawn sky

JULY 14 NASA New Horizons space probe at closest approach to Pluto

JULY 15 New Moon, 9:24 p.m., EDT

JULY 16 Mercury and Mars 24 arc minutes apart very low in morning sky

JULY 18 Thin waxing crescent Moon 1.5° from Venus low in evening sky; Jupiter nearby

JULY 24 First-quarter Moon

JULY 25 Dwarf planet Ceres at opposition (closest and brightest for 2015); waxing gibbous Moon 3° from Saturn in evening sky

JULY 29 Southern Delta Aquarid meteor shower peaks in bright moonlit sky

JULY 31 Full Moon, 6:43 a.m., EDT ("blue moon"—second full Moon of the month)

AUG. 2 Saturn stationary in Libra; resumes eastward motion into Scorpius

AUG. 6 Mercury, Jupiter and Regulus in tight 1.5° grouping very low in evening sky from Canada; last-quarter Moon

AUG. 10 Jupiter 24 arc minutes north of Regulus (likely too low and too close to Sun to observe at dusk)

AUG. 12 Perseid meteor shower peaks in good moonless skies

AUG. 14 New Moon, 10:53 a.m., EDT

AUG. 15 Venus at inferior conjunction 8° south of Sun in daytime sky

AUG. 20 Mars in Beehive star cluster (M44) low in dawn sky

AUG. 22 First-quarter Moon; waxing Moon 5° east of Saturn in evening sky

AUG. 26 Jupiter in conjunction with Sun; Uranus 27 arc minutes south of fifth-magnitude zeta Piscium

AUG. 29 Full Moon, 2:35 p.m., EDT

Impressive or relatively rare astronomical event

THE PLANETS

MERCURY starts July low in the morning sky, passing near Mars on July 16. It then emerges into the evening sky in August, passing just 40 arc minutes north of Jupiter on Aug. 6. However, the two planets are very low in the evening twilight, and this evening appearance of Mercury is a poor one from Canadian latitudes.

VENUS passes very close to Jupiter on July 1, the most impressive planetary conjunction of 2015. Venus is at its maximum brightness on July 9, at magnitude –4.7, but soon drops into the evening twilight, disappearing from view by the end of July and ending its evening appearance for 2015. Venus passes 8° south of the Sun at inferior conjunction in the daytime sky on Aug. 15. The crescent Moon passes 1.5° from Venus on July 18.

MARS emerges from behind the Sun in July, appearing as a 1.8-magnitude reddish "star" in Cancer. It passes 24 arc minutes from Mercury on July 16. On the morning of Aug. 20, Mars passes through the Beehive star cluster, M44.

JUPITER appears close to Venus on July 1 (see Venus entry above), but both planets drop toward the Sun through July. By early August, Jupiter is lost in the solar glare and is in conjunction behind the Sun on Aug. 20.

SATURN is the primary planet this summer, shining at magnitude 0.3 to 0.4 in Libra, just west of the head of Scorpius, low in the south. Saturn sinks lower into the summer twilight through July and August. The waxing gibbous Moon appears 3° above Saturn on July 25.

URANUS can be seen in the late-night sky this summer as a 5.8-magnitude object just ½° below the fifth-magnitude star zeta Piscium. Uranus is closest to zeta on Aug. 26.

NEPTUNE can be sighted in the late-night sky as a 7.8-magnitude bluish "star" about 3° west of the fourth-magnitude star lambda Aquarii. Neptune reaches opposition on Sept. 1, when it is closest and brightest for 2015.

DWARF PLANETS Ceres reaches opposition on July 25, shining at magnitude 7.5 in southern Capricornus. Pluto reaches opposition on July 6, when it appears as a 14th-magnitude object near the stars xi[1] and xi[2] Sagittarii.

Cartography and design by Roberta Cooke. Base chart data derived from maps drawn by Roy Bishop for the *Observer's Handbook*, published by The Royal Astronomical Society of Canada.

For more detailed information, see the *Observer's Handbook 2015*, published by The Royal Astronomical Society of Canada (www.rasc.ca or 888-924-7272).

ROTATING NIGHT SKY: During the night, the Earth's rotation on its axis slowly shifts the entire sky. This is the same motion that swings the Sun on its daily east-to-west trek. The rotational hub is Polaris, the North Star, located almost exactly above the Earth's North Pole. Everything majestically marches counterclockwise around it, a motion that becomes evident after about half an hour.

CONSTELLATIONS: The star groups linked by lines are the constellations created by our ancestors thousands of years ago as a way of mapping the night sky. Modern astronomers still use the traditional names, which give today's stargazers a permanent link to the sky myths and legends of the past.

PERSEIDS

The Perseid meteor shower peaks under ideal dark sky conditions in August. In July, Pluto gets a visitor, inviting a look at Pluto's hidey-hole in the summer Milky Way. *by Alan Dyer*

AND PLUTO THIS SUMMER

METEORS IN MOONLIGHT Last year's Perseid meteor shower was washed out by moonlight, so only the brightest meteors appeared to the eye and the camera. This year, the annual Perseids peak under ideal dark skies on August 12.
PHOTO BY ALAN DYER

VENUS AND JUPITER start the season with a fine conjunction in the evening twilight on Canada Day. Saturn shines in the south as our main summer planet, though low enough that observers need to catch it early in the evening for the best view. Mercury and Mars hang on the fringes of the sky, appearing low in the dawn sky for Mars and in both the dawn and dusk skies for fast-moving Mercury.

Dwarf planets Ceres and Pluto each come to opposition this summer, putting them as close to Earth and as bright as they will be for 2015. With spacecraft now visiting both of these icy worlds, tracking down their location is a great summer-stargazing challenge.

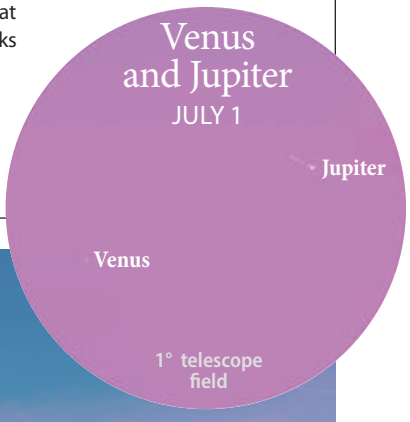
While Pluto gets all the press this summer, the observing highlight is the annual and always eagerly anticipated Perseid meteor shower, on the night of August 12/13. This year's edition coincides with the new Moon, so skies will be dark—the ideal circumstance for enjoying an evening under "shooting stars."

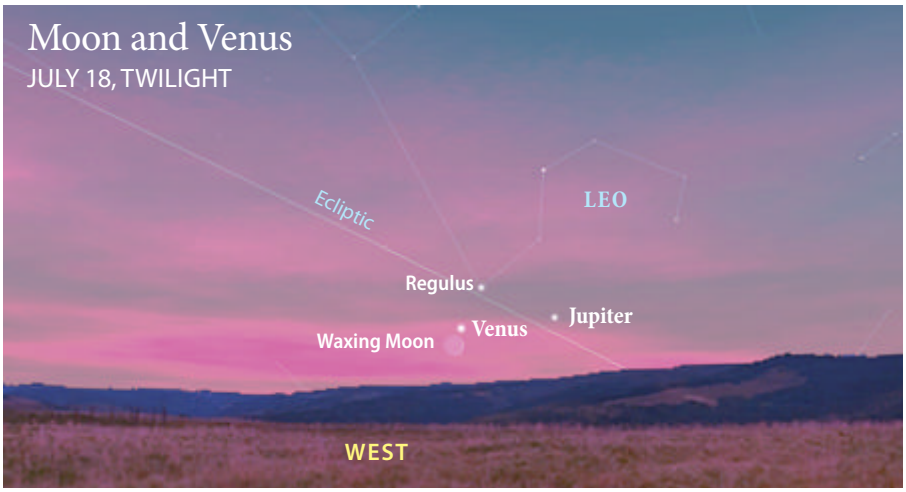
VENUS PEAKS IN BRILLIANCE

We've enjoyed Venus as a dazzling evening "star" throughout the spring. But now Venus is on the decline—at least in altitude, but not brightness.

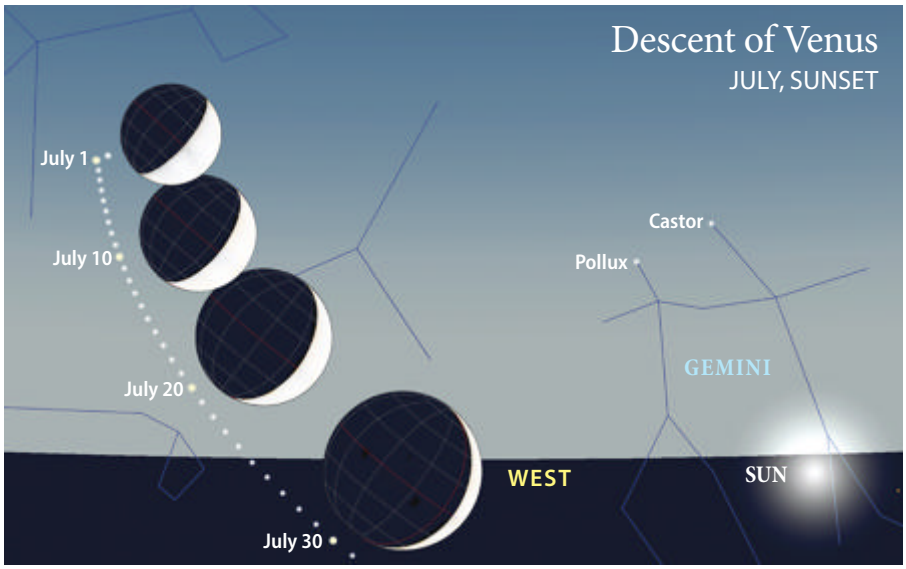
Venus actually increases in brightness in early July, peaking at a blazing magnitude –4.7

CANADA DAY CONJUNCTION Venus and Jupiter lie only 40 arc minutes apart on the evening of Canada Day, July 1. They set at about 11:30 p.m., so the pair should be visible behind fireworks displays. We expect some great pictures from our readers. Inset: On July 1, the two planets are close enough to be contained in a low-power telescope field. By coincidence, they both present the same size disc, 32 arc seconds across.
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)



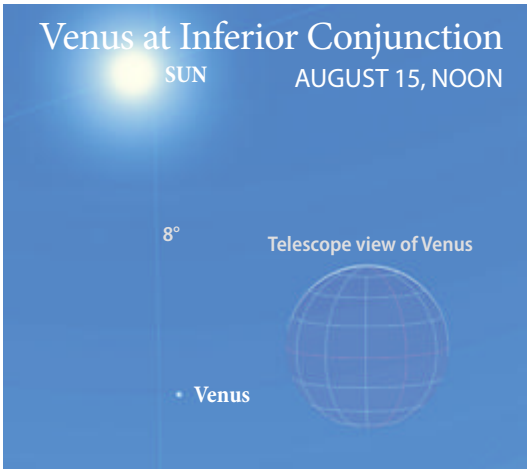


LOW IN THE GLOW By mid-July, Venus and Jupiter have separated, but on July 18, the thin crescent Moon sits 1.5 degrees below Venus, low in the western twilight as viewed from Canadian latitudes. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.



VENUS ON THE DECLINE This chart plots the position of Venus for southern Canadian latitudes at sunset through July. The magnified discs depict the relative size and phase of Venus, showing how the disc increases in diameter but wanes in phase as it descends and approaches closer to the Sun. Because of the low angle of the ecliptic in summer from Canada, Venus drops out of sight in the west by the third week of July. BASE SKY CHART COURTESY THESKYX™/SOFTWARE BISQUE

RAZOR-THIN VENUS Using an aligned GoTo telescope and exercising extreme caution so as not to aim at the Sun, it should be possible to sight Venus at midday on Saturday, August 15, as it passes eight degrees below the Sun at inferior conjunction. Venus will appear as a sliver-thin crescent. If you are attending a star party that weekend, no doubt someone will have a view of Venus at midday. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.



during the second and third weeks of July. Two main factors contribute to any planet's changing brightness: its proximity to Earth, and therefore the apparent size of its disc, and its phase. Venus is at full phase only when it is farthest from Earth on the opposite side of the Sun, when it is at its smallest size. Venus is approaching its closest point to Earth in July and passes between the Sun and Earth on August 15, so its disc is now ballooning in apparent size. Remember, Venus is the planet that comes closest to Earth, which is just what it is doing this summer.

While it does so, its phase is waning from a wide crescent on July 1 to a thin crescent at the end of July. The dropping brightness from Venus's decreasing phase is more than made up for by the increasing size of its disc. The result is that on July 9, the greatest area of the Venusian disc is illuminated by the Sun and therefore reflects the maximum amount of light back to us, at magnitude –4.7, Venus's greatest brilliancy. Nothing else in the night sky competes, except the Moon, some flaring Iridium satellites and, on occasion, the International Space Station.

But despite its brilliance in July, Venus may not be obvious to most people, as it shines low in the bright twilight. But do look on Canada Day. Amid the fireworks, you might see a close pairing of bright "stars" in the west. One is Venus. The other is Jupiter, also ending a prominent evening appearance. Interestingly, at that time, both planets will be the same apparent diameter in a backyard telescope.

JUPITER BOWS OUT

Jupiter shone high in the winter and spring sky as a bright object on the Cancer-Leo border. Now, as summer begins, Jupiter is being carried lower and lower into the west as the spring constellations drop into the twilight glow. In July, Jupiter shines at a respectable magnitude –1.8, second only to Venus and brighter than any star.

However, we don't have long to look at Jupiter. By mid-August, it will be a tough sighting as it approaches its date of superior conjunction behind the Sun on August 26, 11 days after Venus reaches inferior conjunction between us and the Sun. Before that, mark your calendar for July 18, when Jupiter shines a binocular field north of the main event that evening, a close conjunction of the thin crescent Moon and Venus.

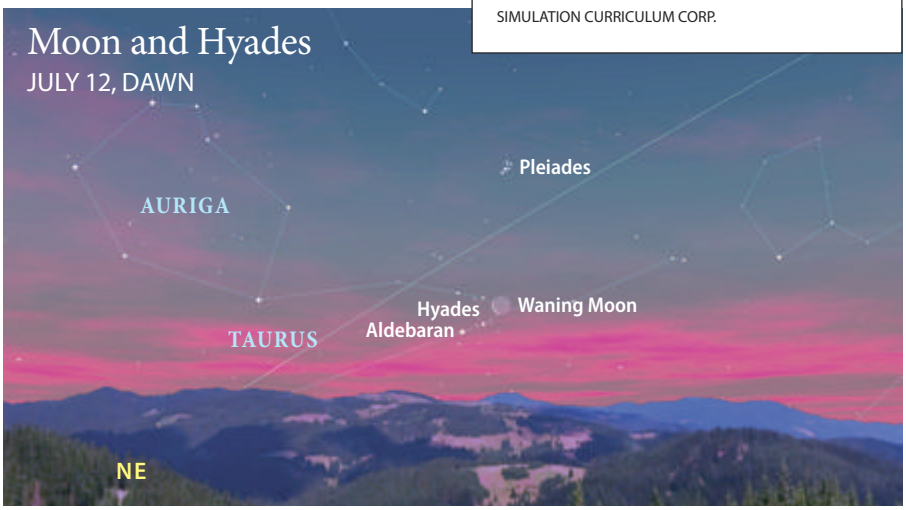
MERCURY MAYBE

While Mercury does put in an evening appearance in August, the low angle of the evening ecliptic at this time of year keeps Mercury hugging the horizon all month. It reaches its greatest angle away from the Sun on September 4, but by then, the inner planet is too low to easily sight from Canada.

Mercury actually begins the summer as a morning "star" low in the eastern dawn sky. It was at its greatest elongation away from the Sun on June 24 and opens July low in the east and getting lower.

On July 16, Mercury, on the decline, passes Mars, then on the rise into the east-

MORNING MOON Look east at dawn on July 12 to see the old waning Moon shining among the stars of the Hyades star cluster, in the face of Taurus the bull, a winter constellation climbing into the sky at sunrise. COURTESY STARRY NIGHT PRO PLUS™/ SIMULATION CURRICULUM CORP.



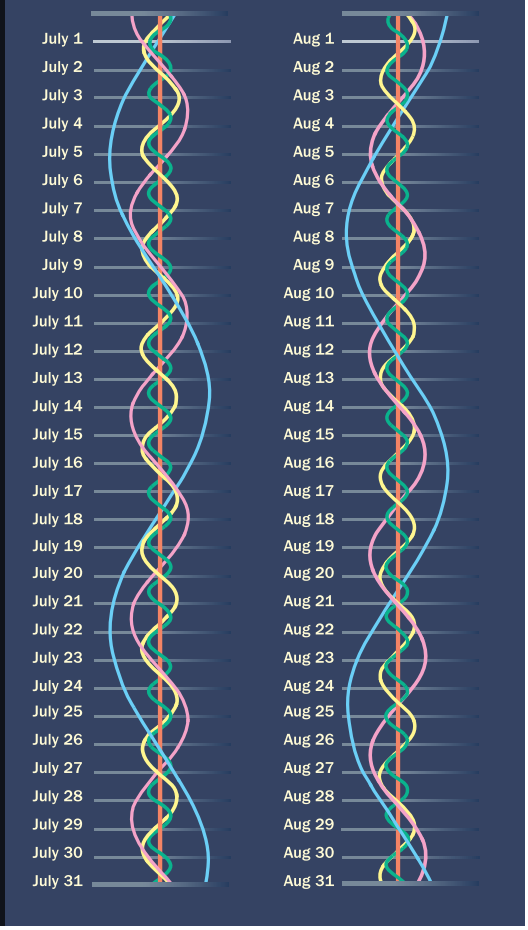
JUPITER'S MOONS

July and August 2015

The positions of Jupiter's four largest moons are shown for each night of the two-month period. Jupiter is represented by the central vertical shaft, while the moons are the four wavy lines. The horizontal lines mark 8 p.m., EDT, on the dates indicated. Time flows from top to bottom, so look proportionately below the line for later times on a particular date. East is to the left, and north is at the top, as seen in binoculars. From closest to farthest, the moons are Io, Europa, Ganymede and Callisto. Orbital periods are 1.8, 3.6, 7.2 and 16.7 days, respectively.

KEY:

Io Europa Ganymede Callisto

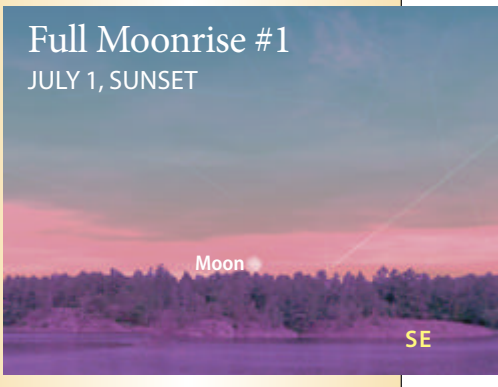


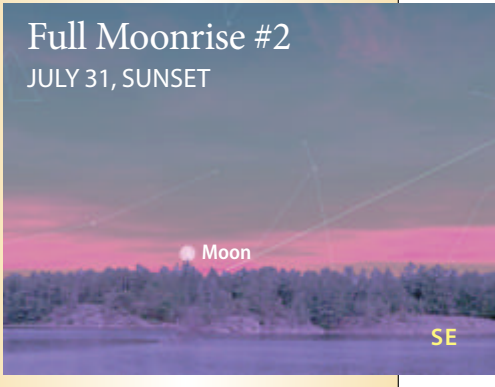
TWO MOONS OF JULY

Hot on the heels of the much-publicized "blood-red" Moon of April 4, when the full Moon underwent a total eclipse, comes the "blue" Moon of July. Unlike an eclipsed Moon, a so-called blue Moon does not actually look any different and certainly isn't blue. As it has become defined in recent years, a blue Moon is the second full Moon within a calendar month, something that happens about every 2½ years. It has no astronomical significance whatsoever, but the news-media folks like to mention it regardless.

The Moon is full on the night of July 1, when it rises in the southeast at sunset. One lunar cycle later, the Moon is full again. The lunar-phase cycle, or lunation, is 29.5 days long, so when a full Moon occurs on the first day of a 31-day month, that month will contain the next full Moon as well. Therefore, on July 31, we see another full Moon, now rising a little farther north than the full Moon on Canada Day.

Despite what click-bait Internet hype would have you believe, don't expect either of the full Moons of July to look special. The next month with two full Moons will be January 2018. COURTESY STARRY NIGHT PRO PLUS™/ SIMULATION CURRICULUM CORP. (BOTH)





ern sky. The two worlds shine just 24 arc minutes apart in another close but challenging conjunction in bright twilight.

MARS IN THE MORNING

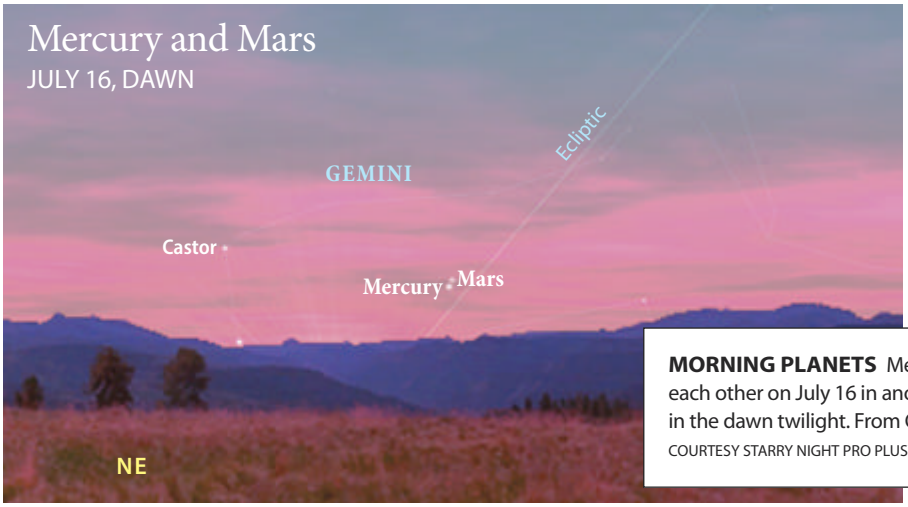
The red planet shone in the evening sky through the winter and early spring but disappeared behind the Sun in June. It reached conjunction behind the Sun on June 14.

Now, in July and August, Mars is beginning to emerge from the Sun's glare as a dim morning "star." Its disc is so small—less than four arc seconds across—that seeing any detail through a telescope is impossible, even if it were not buried so low in atmospheric haze and turbulence.

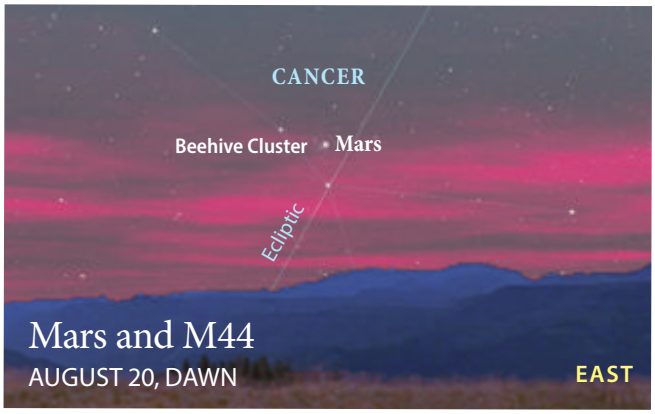
One Martian event this summer is worth noting and rising early to observe. On the morning of August 20, Mars passes directly through (or so it appears) the bright Beehive star cluster, a.k.a. Messier 44, in Cancer. Mars will then be at magnitude 1.8, shining as an extra-bright, reddish "star" stirring up the Beehive.

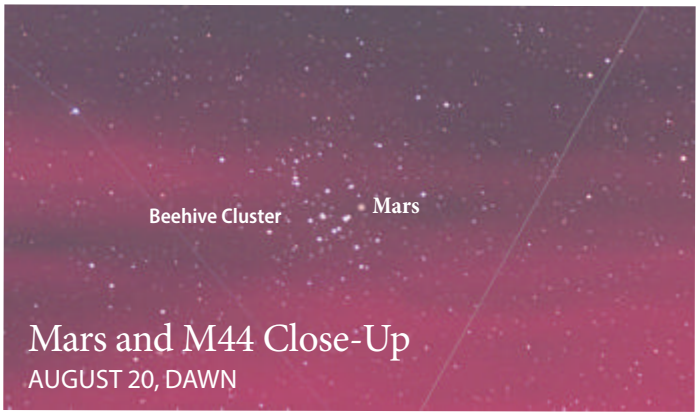
SATURN IN THE SOUTH

The planetary showpiece of the summer sky this year, and for the next few years, is Saturn. After spending the winter and spring across the border in northern Scorpius, it shines as a bright 0.4-magnitude

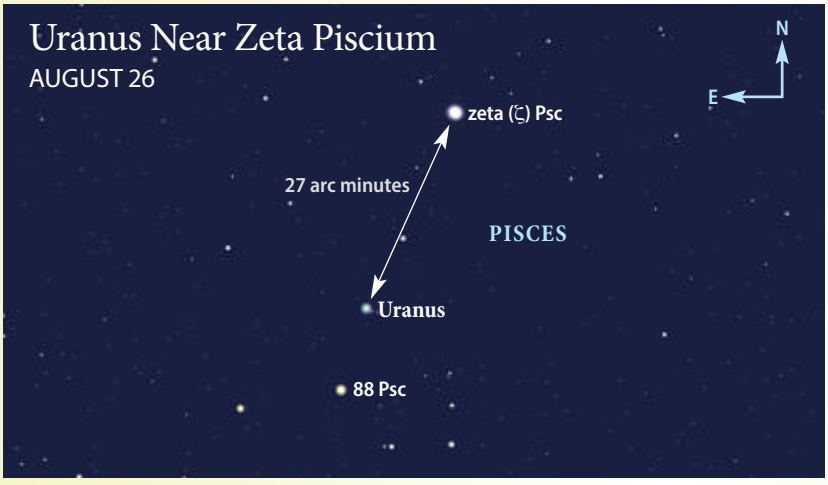


MORNING PLANETS Mercury and Mars pass within 24 arc minutes of each other on July 16 in another close but very low conjunction, this time in the dawn twilight. From Canada, this will be another tough sighting!
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.



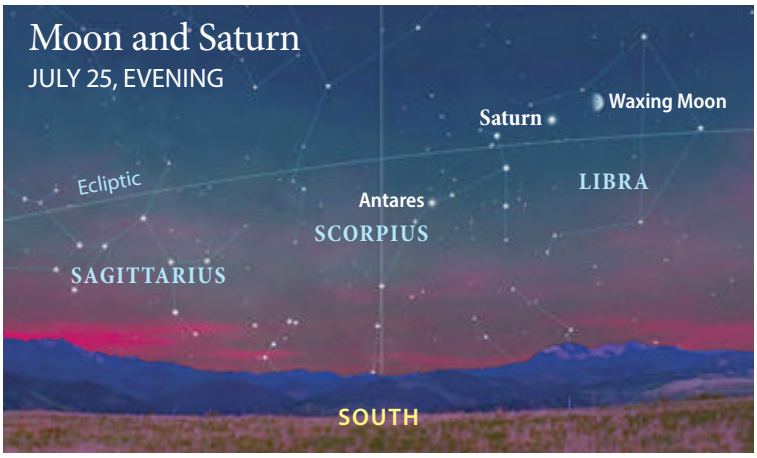


MARS MEETS M44 As it emerges into the dawn sky, Mars passes through the constellation Cancer and directly in front of the Beehive star cluster, Messier 44, on the morning of August 20. Like many of the summer conjunctions, this one occurs with the participants low and embedded in twilight.
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)

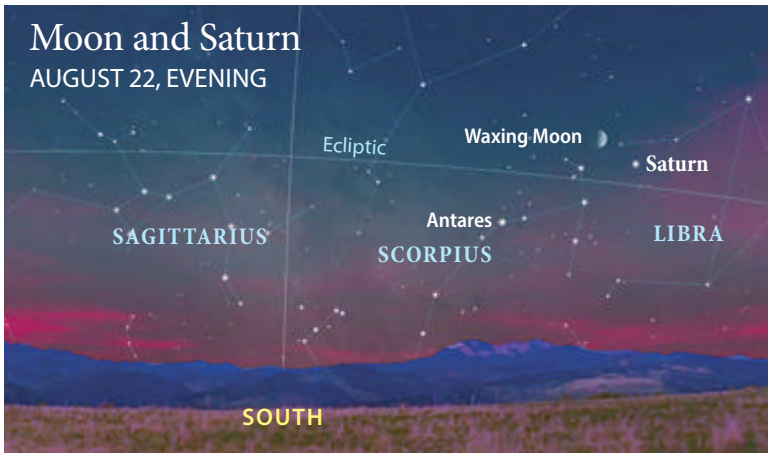


FINDING URANUS **This summer, Uranus continues its trek through southern Pisces. The seventh planet will be easy to find as it passes just south of the fifth-magnitude, naked-eye star zeta Piscium. However, Uranus does not reach opposition until October 12, so locating the planet this season requires a late-night session to catch it due south at about 3 a.m., local time.**

URANUS CONJUNCTION
Uranus comes closest to zeta Piscium on August 26, when it passes 27 arc minutes (half a degree) south of the 5.2-magnitude star. At magnitude 5.8, Uranus is slightly dimmer but appears distinctly green in a telescope.
COURTESY THESKYX™/SOFTWARE BISQUE



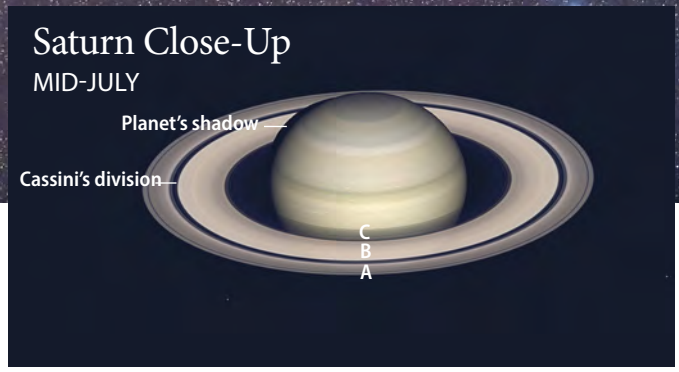
JULY MOON PASSES SATURN In July, Saturn shines due south at night fall as a 0.3-magnitude "star" in Libra. On July 25, the waxing gibbous Moon appears three degrees to the west of the ringed planet.



AUGUST MOON PASSES SATURN A month later, Saturn is beginning to sink into the southwest as the sky darkens. The waxing Moon, now at first quarter, shines a wide five degrees east of Saturn.

COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)

SATURN IN SCORPIUS This photo was taken on March 28, when Saturn shone in the head of Scorpius, above the star beta Scorpii. But now the planet has retrograded west across the border into Libra. On August 2, Saturn stops its retrograde motion and will spend the rest of the summer and autumn moving east, back into Scorpius. PHOTO BY ALAN DYER



SHADOW ON THE RINGS Through a telescope, you should be able to see Saturn's shadow projected onto the far side of the rings, as well as Cassini's division dividing the A and B rings and possibly the grey C ring in silhouette across the disc of the planet. COURTESY THESKYX™/SOFTWARE BISQUE

object in the constellation Libra. Since mid-March, Saturn has been retrograding westward among the stars, crossing back into Libra in mid-May.

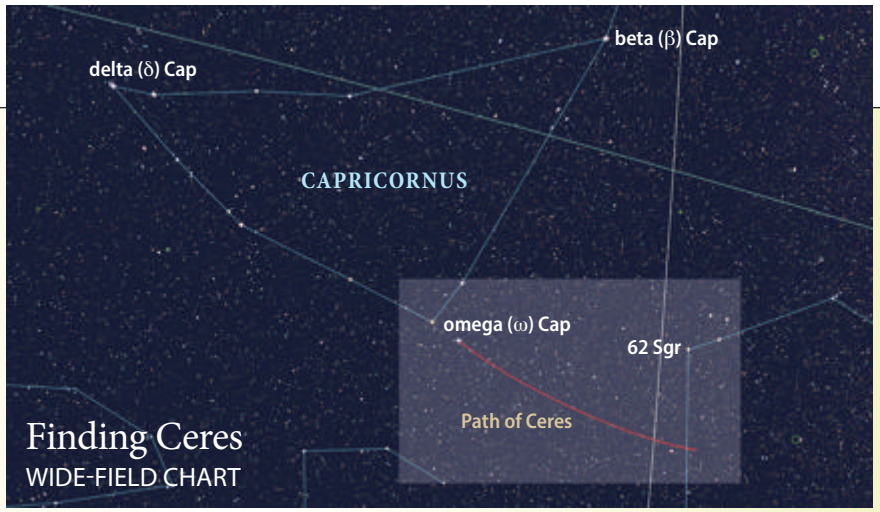
Saturn spends July completing its annual retrograde motion, coming to a stop on August 2. It then resumes its normal "prograde" motion, slowly moving eastward toward the Libra-Scorpius border. It won't make the border crossing until mid-October. The upshot is to look for Saturn this summer just west of the head of Scorpius, shining as a bright "star" low in the south. If you want a good telescopic view of the planet, catch it as early as you can in the season, since Saturn, along with Libra and Scorpius, will sink lower and lower into the southwest as the summer goes by.

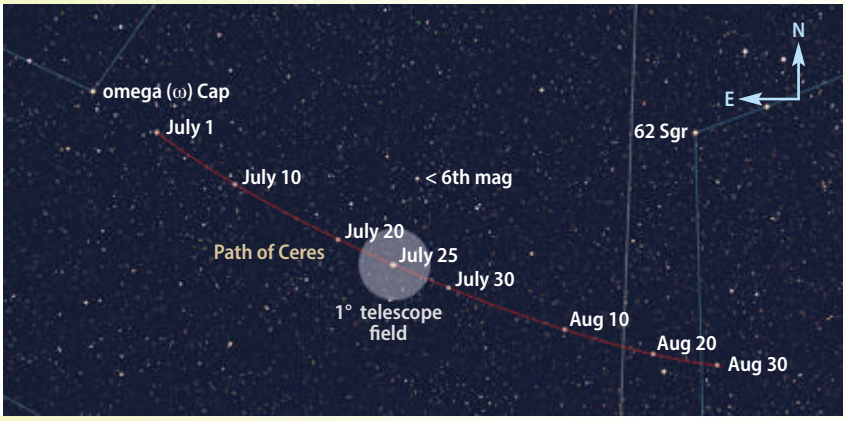
Through a telescope, Saturn's rings—tipped 24 degrees to our line of sight—now appear almost as wide open as they can get. We are peering down at the northern face of the rings and the northern hemisphere of Saturn, as summer comes to the northern half of the ringed planet. Look for the shadow of the planet projected across the back of the rings, on their eastern side. The shadow contributes to Saturn's three-dimensional appearance, a trait that no other planet exhibits.

PERSEIDS PEAK IN MIDWEEK

Wednesday, August 12, is a red-letter day for summer stargazing. That's the peak night of the annual Perseid meteor shower. Not only does August 12 nearly coincide with new Moon, but the peak hour for the shower falls in the middle of the night for North America, at about midnight, MDT

FINDING DWARF PLANET CERES
The largest object in the main asteroid belt comes to opposition this summer, on July 25. Ceres will then shine at magnitude 7.5, putting it well within reach of any telescope and even binoculars. The challenge is that despite its diameter of 975 kilometres—nearly twice the size of the next largest asteroid—Ceres will look like a star, even at high power. The attraction is simply seeing a world that is now being mapped in wonderful detail, courtesy of NASA's Dawn probe.

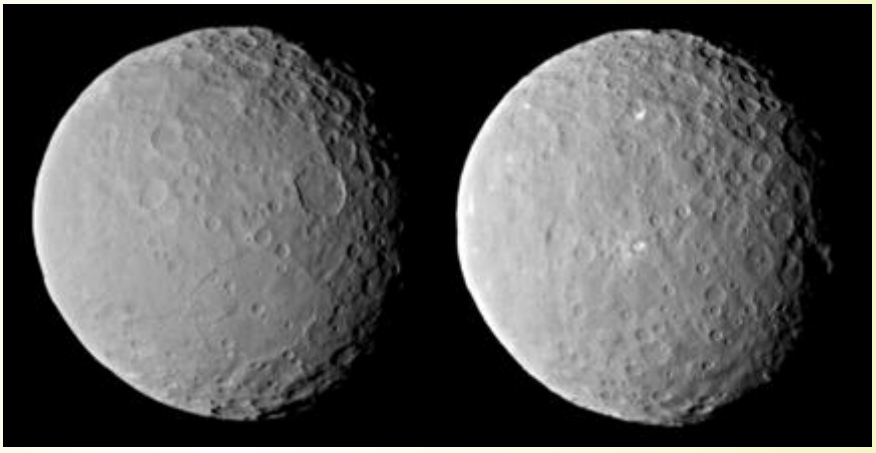




SEEKING CERES IN CAPRICORNUS Finding Ceres this summer from Canada will require a site with a good view to the south, as the dwarf planet loops through southern Capricornus. Ceres is at its brightest on July 25. To find this area of sky, look due south about 1 a.m., local time.

SUMMER PATH FOR CERES A good time to look for Ceres is in mid-July, with the Moon out of the way and the dwarf planet approaching opposition, before it sinks too far south. Unfortunately, Ceres travels through an area of sky with few bright stars to guide your way in a star-hop.

COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)



CERES REVEALED Looking like no more than a star in our telescopes for 200 years, Ceres has emerged, through images taken by the Dawn orbiter, as an icy cratered world more like the outer moons of Jupiter and Saturn than the smaller rocky asteroids. Ceres may be typical of the proto-planets that formed the major planets we know today and brought water to Earth through collisions early in the Earth's history.

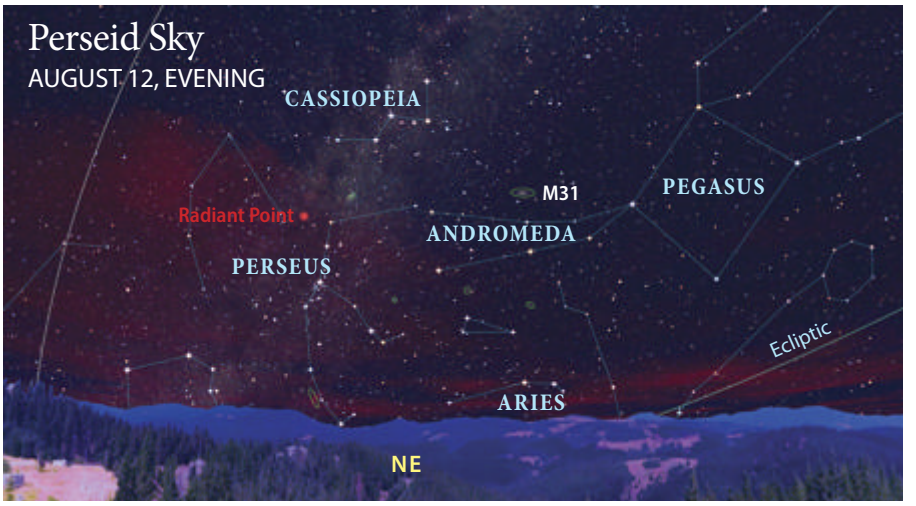
COURTESY NASA/JET PROPULSION LABORATORY

(2 a.m., EDT), on August 13, again contributing to a better-than-average shower for summer stargazers.

You are seeing dust particles ejected by Comet 109P/Swift-Tuttle, which last returned in 1992. The early 1990s were vintage years for the Perseids, with even higher-than-normal rates due to Earth passing through denser dust clouds travelling closer to the comet. The meteor counts have declined since then, but the Perseids still put on a good show.

Meteor expert Jeremie Vaubaillon is predicting an additional earlier peak for 2015, as we intercept particles ejected from Swift-Tuttle in 1862. However, this peak is expected to occur at 2:30 p.m., EDT, on the afternoon of August 12, making it invisible to visual observers in North America. Nevertheless, watching right from nightfall on August 12 will be a good idea, in case this unique 2015 peak does perform and persists for several hours.

Assuming normal levels of activity, you can expect to see about 40 to 80 meteors an hour from a dark site. Most will be faint, but a few will burn across the sky with long, bright trails that persist for several seconds or even minutes.



RADIATING FROM PERSEUS Look northeast on the evening of August 12 to see Perseid meteors radiating from a point near the head of Perseus, the hero who rescued Andromeda, daughter of Queen Cassiopeia. Lie back, gaze skyward, and enjoy the meteors and mythological panorama in the stars.

PERSEID FROM ABOVE Astronaut Ron Garan took this image of a Perseid meteor burning up high in the atmosphere on August 13, 2011. The space station was over China at the time. Note the green airglow near the edge of space, at an altitude of about 50 kilometres. COURTESY NASA

GRAVENHURST MUSKOKA
FAMILY STARGAZING EVENT
Friday, Sept. 11, and Saturday, Sept. 12, 2015
Gravenhurst KOA, 1083 Reay Road
and Torrance Barrens Dark Sky Site

SATURDAY, Gravenhurst Opera House
11 am – 1:30 pm: Solar Viewing
2 pm: Workshop (registration required)
Free Draws!
- Setting Up Your Scope and Binoculars Properly
- Astronomy on a Shoestring

7 pm: ASTRO TALK "Year of Discovery in Astronomy"
by Francois van Heerden, Life Member, RASC Toronto Centre
Talk will be followed by stargazing at Gravenhurst KOA and Torrance Barrens, with experts at KOA to answer questions. Extra equipment will be available for use.

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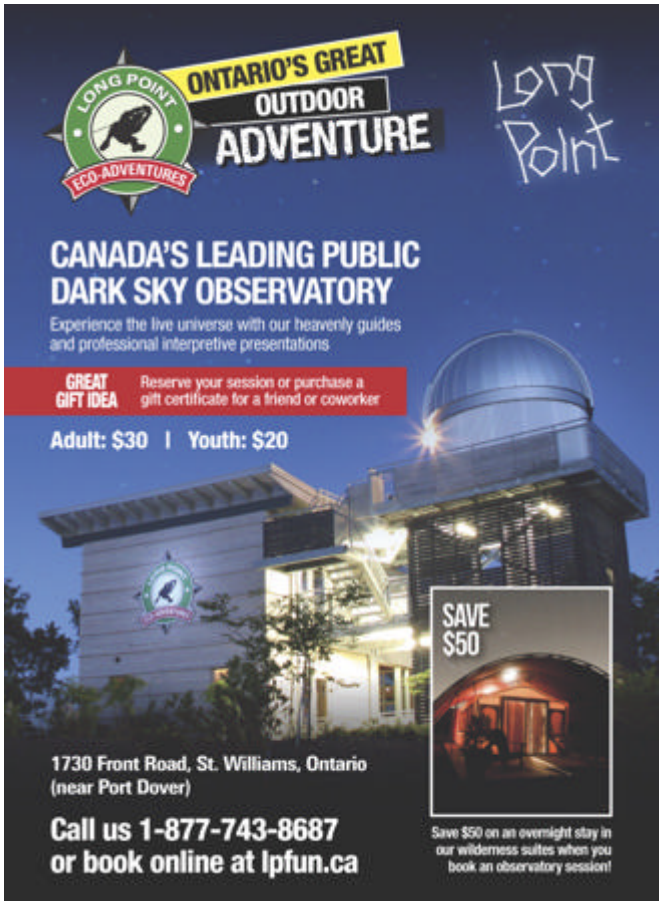


Rates will likely climb through the night, with more activity after local midnight as Earth turns into the incoming meteors. This causes the meteor particles to hit our atmosphere with increasing speed, brightening the meteors. All burn up high in the atmosphere. No objects from a meteor shower ever reach Earth, as the cometary dust particles are too fragile.

Watching meteors couldn't be easier. Simply lie back in a comfy lawn chair and look up. While Perseids seem to be streaking away from Perseus, in the northeast, they can appear anywhere in the sky. The only downside to the 2015 Perseids is that the peak night occurs midweek, on a Wednesday. But the ideal viewing prospects make this a good week to schedule some vacation time.

A DWARF PLANET DUO

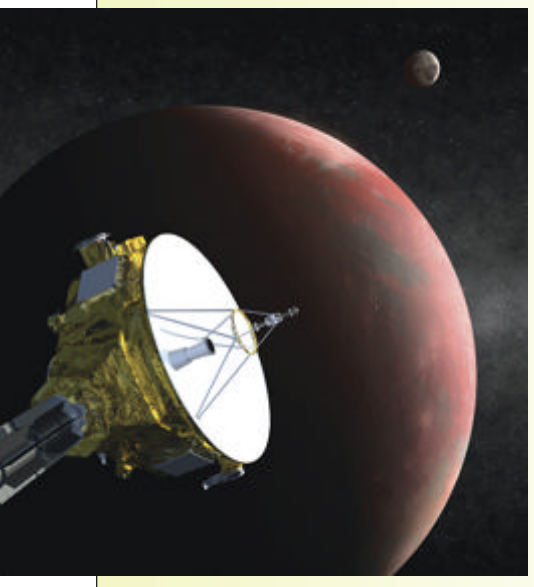
This is the year of the dwarf planet, with NASA space probes visiting both nearby Ceres, in the asteroid belt, and distant Pluto. The Dawn probe was captured by the gravity of Ceres on March 6 but didn't begin its main mission there until mid-April, when its orbit had been best shaped for mapping the large ice world. Ceres is the first asteroid to be discovered, in 1801.

For several decades, Ceres and three other large asteroids discovered in quick succession (2 Pallas, 3 Juno and 4 Vesta) were all referred to as planets. During the first half of the 1800s, our solar system contained 11 planets.

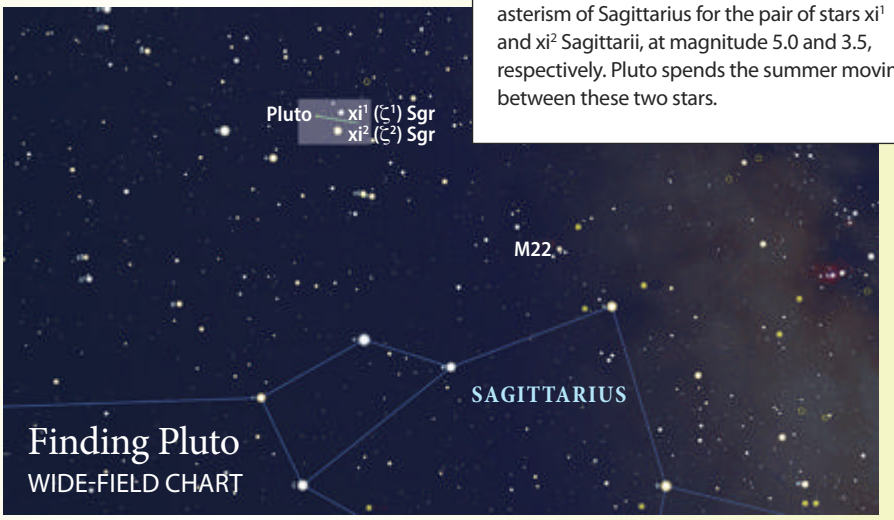
Neptune's discovery in 1846 would have brought that count to 12. But by the mid-1800s, the dam broke on asteroid discoveries. Soon hundreds were being found, most orbiting between Mars and Jupiter. The "big four" worlds were demoted from full planet status to become classed as minor planets or, to use the great astronomer William Herschel's term, "asteroids" for their starlike appearance in a telescope.

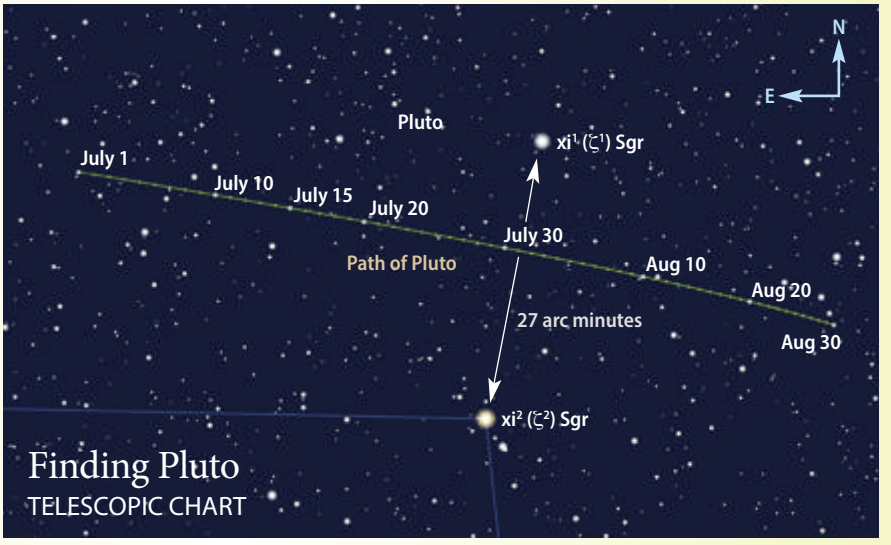
PLUTO IN SAGITTARIUS To locate the field with Pluto, look above the familiar Teapot asterism of Sagittarius for the pair of stars xi^1 and xi^2 Sagittarii, at magnitude 5.0 and 3.5, respectively. Pluto spends the summer moving between these two stars.

FINDING DWARF PLANET PLUTO
With Ceres, you are looking for a bright target in a star-poor region of sky. By contrast, Pluto is now travelling in a star-rich region between two naked-eye stars, making it easy to locate the field. Finding Pluto itself is another matter. Pluto reaches opposition on July 6, when it is at its brightest for 2015. But "bright" for Pluto means magnitude 14.1, so dim that you'll need a 10- to 12-inch telescope to spot it.



PLUTO AT LAST! Closest approach to Pluto by New Horizons occurs at 7:50 a.m., EDT, on July 14. We will see a single approach image the night before and won't see images taken on encounter day until a day after closest approach, on July 15. A handful of compressed "first-look" images will be downlinked from July 15 to 20, but most of the images will not be sent back until September and into next year. Pluto requires patience. COURTESY NASA





PLUTO PASSAGE Pluto appears east of xi^1 and xi^2 Sagittarii in early July. On July 14, when NASA's New Horizons space probe makes its closest passage by the planet, Pluto and the two stars form an equilateral triangle, with sides half a degree (about 30 arc minutes) long. The Moon is new, and the sky is dark. In late July and early August, Pluto passes between xi^1 and xi^2, making it easy to find the field, though the Moon will then be full, so sighting 14th-magnitude Pluto will be nearly impossible. Limiting magnitude for this chart is 13.5. COURTESY THESKYX™/SOFTWARE BISQUE (BOTH)

NOT EXACTLY AS ILLUSTRATED
Pluto probably does not resemble this NASA artwork, but we will find out this year when New Horizons shows regions of the dwarf planet in the same detail that backyard telescopes reveal the Earth's Moon.
COURTESY NASA

Pluto, the other dwarf planet receiving a visitor this year, suffered a similar fate. Known as a planet for 75 years, it was officially demoted to dwarf planet status in 2006 because of a similar advance in science as astronomers discovered more and more worlds in the outer solar system. Some, such as Eris, are as large as Pluto.

Call Pluto what you will, the fact is that Pluto and its five moons are going to prove to be fascinating worlds, the first representatives of the outer Kuiper belt to be seen up close. NASA's New Horizons space probe is scheduled to fly through the Plutonian system on July 14, with a handful of "first-look" images due to arrive over the following few days.

Radio signals from New Horizons take 4.4 hours to reach Earth from this distance. However, the delay between when the probe takes an image and when we get it is determined more by when downlinks are scheduled on the probe. New Horizons must turn its instruments away from the target in order to aim its dish at Earth and relay information, which streams back to us at slower than dial-up modem speeds (for those who remember such ancient technology).

Data rates from Pluto are only one kilobit per second, requiring 42 minutes to transmit one lossless image from the main camera. To transmit all the data gathered by New Horizons in just hours or days in July will require a full year.

With all the interest in Pluto this season, it will be worthwhile aiming a telescope at its location at summer star parties. Keeping that in mind, I present our Pluto finder charts so that you can at least get into the area and aim your telescope at the field. Sighting Pluto itself, shining at a dim magnitude 14.1 amid so many stars in the Sagittarius Milky Way, will be an extreme challenge.

To make a positive ID, check the RASC *Observer's Handbook* for a detailed finder chart or use advanced planetarium software capable of plotting stars down to magnitude 15. Even if you don't see Pluto itself, you will know that it and New Horizons are there—somewhere! Should you identify Pluto, ponder the fact that a machine from Earth is passing by this tiny, cold world, sending us images and information from 4.9 billion kilometres away. We do live in amazing times. ✦

DEEP INTO THE NIGHT

Some splendid distant nebulas and galaxies are within reach of backyard astro-imagers

► **LARGE BUT FAINT IC342** This face-on spiral galaxy in the dim constellation Camelopardalis is about two-thirds the apparent width of the Moon but is extremely faint. Obscured by dust in the arms of our own Milky Way Galaxy, IC342 is a challenge to observe and to image. It lies about 11 million light-years from us. The image shows off pinkish star-formation regions as well as dusty lanes in the arms of the galaxy. To take this shot, Ron Brecher of Guelph, Ontario, used an SBIG STL-11000M camera with Baader RGB filters on a 10-inch f/6.8 ASA astrograph.

▼ **HORSEHEAD NEBULA REGION** Using a Teleskop Service Star 71mm f/4.9 astrographic refractor, Lynn Hilborn of Grafton, Ontario, captured the dust- and gas-laden sector of Orion that includes the famous Horsehead Nebula (upper right), M78 (centre) and Barnard's Loop (lower left). He took 29 exposures, each 4 minutes, at ISO 3200 using a modified Canon 6D.

▲ **GALAXIES IN LEO, M96 AND M95** Using his 12-inch Newtonian reflector, Gord Rife of Schomberg, Ontario, secured this multihour digitally stacked image of the spiral galaxies in central Leo (M96 is at left). The duo is about 35 million light-years away.

◄ **DISTANT GALAXIES** Known as Hickson 44, this group of galaxies lies in the constellation Leo, at a distance of 80 to 100 million light-years. The largest galaxy (near centre) is NGC3190. Above it is the S-shaped galaxy NGC3187. Near upper right is NGC3185, and the elliptical galaxy NGC3193 is toward the bottom left. These four galaxies are interacting gravitationally with one another and becoming distorted in the process. For a sense of scale, NGC3190 is roughly 75,000 light-years across. Frequent *SkyNews* contributor Ron Brecher of Guelph, Ontario, used a 10-inch astro–graphic reflector to take this image. For technical details, see www.astrodoc.ca.

PUBLIC OBSERVATORIES FLOURISH IN RAINY BRITISH COLUMBIA

Two special venues for observation are available on the West Coast *by David A. Rodger*

SOUTHWESTERN BRITISH COLUMBIA has Canada's mildest climate. Heavy snowfalls and subfreezing temperatures are uncommon in the winter months. Summers are sunny and warm, with many clear nights. According to my own (unofficial) records, we enjoy a range of between 85 and 110 clear nights a year, including moonlit ones.

But as *The X-Files* actor David Duchovny once remarked to TV talk show host Conan O'Brien about the city where *The X-Files* was filmed, "Vancouver is a very nice place if you like 400 inches of rainfall a day." He exaggerated a little, of course!

Yes, it rains a lot—mostly between November and April. Despite this, southwestern British Columbia nurtures a remarkable community of people devoted to communicating astronomy to the public. This includes two regular contributors to *SkyNews*, Gary Seronik and Ken Hewitt-White. There are three Centres (branches) of The Royal Astronomical Society of Canada, in Vancouver, Victoria and the "Sunshine Coast." As well, there are many private and club observatories. And, as of April 2015, there are two major observatories dedicated to public viewing, with a third being developed in Mission, about an hour's drive east of Vancouver, in the Fraser River Valley. The two in Vancouver are highlighted in this article.

BUILD IT AND THEY WILL COME
Amateur astronomers set up telescopes beside the new Trottier Observatory (far left) on the Burnaby Campus of Simon Fraser University. The observatory houses a state-of-the-art 28-inch reflector (centre right) fitted with a unique floor-level visual access point provided by 4-inch refractors (centre left). Philanthropist Lorne Trottier (top left) and his brother Howard (bottom left), a physics professor at the university and an avid astrophotographer. See main article for details. PHOTOS COURTESY IAN MCLENNAN

TROTTIER OBSERVATORY AND SCIENCE COURTYARD, SIMON FRASER UNIVERSITY, BURNABY

There was a time when every self-respecting college or university had a campus observatory. Those days are mostly gone now. Today, astronomers reach for the sky in remote high-altitude and desert locations. Howard Trottier is reversing this trend at Simon Fraser University.

By day, Trottier is a professor of particle physics at the university; by night, he's a keen and experienced amateur astronomer and astrophotographer. Spectacular deep-sky photos, taken with the 17-inch PlaneWave CDK17 astrograph in his Okanagan Valley observatory, have been widely published, including in this magazine. Then there's his passion for communicating astronomy to the public. Over the past five years, he has hosted campus "star nights" for the public and schools, so he's the right kind of person to lead the development of a public observatory. Indeed, he was named the 2014 winner of the Qilak Award for Astronomy Communications, Public Education and Outreach from both The Royal Astronomical Society of Canada and the Canadian Astronomical Society.

The main Burnaby Campus of Simon Fraser University is on the summit of a small forested mountain that rises 1,100 feet above an ocean inlet. Geographically, it's in the midst of Metro Vancouver, a region with over two million people. The site chosen for the new observatory is a small grassy area, locally dark but surrounded by brightly lit university buildings—hardly an ideal location for astronomy.

"It's a public outreach project," explains Trottier, "so it has to be where the public can get to it. Even before the observatory was built, we had star parties here on campus where 300 or more people—mostly young families—showed up."

Fortunately, he hasn't had to scrounge to outfit the $2.2 million observatory. "My brother Lorne, his wife Louise and their daughters Claire and Sylvie are Montreal-based philanthropists who love to support scientific projects. They donated the funds for the entire site, including the observatory building, dome, telescope and thematic landscaping, from the Trottier Family Foundation.

"The telescope is an impressive PlaneWave CDK700 28-inch [0.7 metre] Dall-Kirkham," says Trottier, "with accessories for photography, Internet transmission and spectral analysis. It has a dual Nasmyth focus positioned about four feet from the base. We looked at a variety of options for getting the public to the focus conveniently, including a ramp and a wheelchair lift. But these would be hard to squeeze into a small building, and the cost was significant.

"The solution was to design a flexible optical relay system using two 4-inch apochromatic refractors. The viewing end of one refractor is attached to the main instrument. It carries the image to its objective lens, which is snugly lashed to the objective lens of the second refractor. The image is then focused at the eyepiece of the second refractor. And that's where people view it."

Acquiring the instrumentation was easy. Complying with the university's strict guidelines for building construction, profile and environmental impact was challenging. "The university wouldn't allow a dome larger than 20 feet in diameter," says Trottier, "and the building couldn't exceed a height of 18 feet. So we decided to raise the telescope up from ground level by about 4½ feet to reduce the cut-off angle from the horizon. We determined that a 16-degree cut-off angle was acceptable, given the poor observing conditions near the horizon from our location."

Burnaby Mountain weather is capricious, to say the least. Here, snowfalls and fog are quite common during the winter months. Plus powerful updrafts, sudden cloudy periods, temperature changes and other features of the mountain's microclimate challenge anyone planning astronomical activities. Since there are no facilities in the dome other than the telescope itself, it's all or nothing as far as nighttime observing sessions are concerned. "We have little choice but to schedule or cancel at the last minute," says Trottier. "We have about 1,400 people on our e-mail list, which we can activate on short notice. We also have a special cellular phone number people can call before sunset to help them decide whether or not to come up the mountain."

Responsibility for the observatory rests with the office of the dean of science. "Plans are to create an endowment fund

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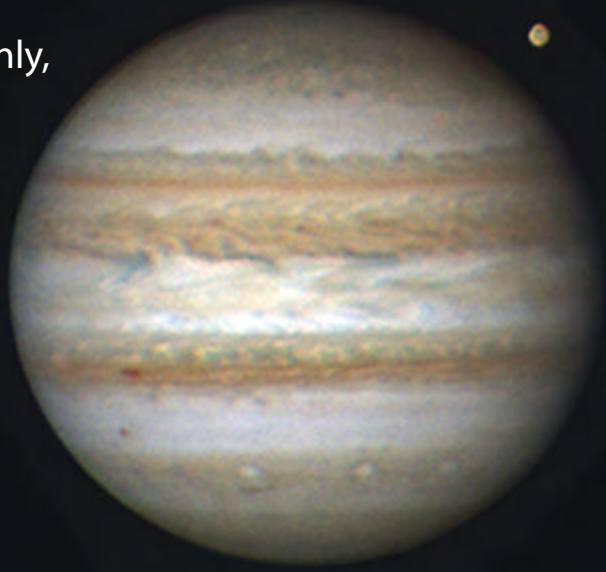

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out of which the support staff will be paid. But for the time being, I'll be there on clear nights, along with university student volunteers and members of the Vancouver Centre of The Royal Astronomical Society of Canada."

GORDON MACMILLAN SOUTHAM OBSERVATORY, VANCOUVER

This observatory in Vancouver's Vanier Park has been in operation for 35 years. I was director of the H.R. MacMillan Planetarium (now Space Centre) when we convinced Jean MacMillan Southam that a public observatory next to the planetarium (named for her philanthropist father) would be a suitable memorial for her late son Gordon.

We chose a VEB Zeiss Jena 6-inch (150mm) refractor on a Coudé mount as the main instrument. Considering that the principal targets, in a location seriously affected by light pollution and the park's tall trees, would likely be planets and the Moon, the refractor was a good choice optically—but the wrong choice!

The Coudé focus meant that the eyepiece location was stationary and at a height convenient for youngsters and people in wheelchairs. But I had overlooked a key component that must be considered in public-observatory planning—the "wow factor." The tiny optical tube assembly in a 33-foot-wide dome didn't impress anyone. And within a few years of my departure, it was replaced by a custom-built 20-inch f/16 Cassegrain instrument.

Lisa McIntosh includes the observatory among her responsibilities as the Space Centre's director of learning. She points out that her doctorate is not in astronomy but in museum education. So she brings a different perspective to the observatory than would an astronomer or a science communicator. "It's a great learning site," she says.

Learning at the Southam Observatory happens in three ways. First, there's what the telescope shows. If the sky is cloudy, Internet feeds and computer software display astronomical events and objects, whether currently visible or recently recorded. Finally, there's the telescope itself, which (from McIntosh's "museum learning" point of view) is an exhibit in its own right. "We offer one program in which fourth-grade students learn about the behaviour of light and how telescopes work."

The observatory is open to the public every Saturday from 8 p.m. to midnight, regardless of sky or weather conditions. In summer, it's open Friday evenings as well. Trained professional staff members and volunteers are always on hand to explain things and to answer questions.

"We look at it this way," says McIntosh. "The telescope is just one of the ways we bring information about astronomical events into the observatory. Weather conditions prevented us from seeing the 2012 transit of Venus and the April 2014 lunar eclipse, but in both instances, we used the Internet to bring images of the phenomena into the observatory. So, regardless of weather, our visitors will have what we hope will be a rewarding experience whenever they visit."

SOUTHAM OBSERVATORY An astronomical observatory next to a major planetarium (background) is an ideal combination. PHOTO COURTESY DAVID A. RODGER

The operators of these public observatories are realists. They know there will be long periods of cloudiness in the maritime climate of southwestern British Columbia. They know that at 49 degrees north latitude, the warm, sunny summer months bring lengthy twilight and short nights. Recognizing this, they have taken steps to ensure that whatever the conditions, visitors to their facilities will still have enriching experiences. ✦

David A. Rodger was the first director of Vancouver's H.R. MacMillan Planetarium (from 1967 to 1980) and has been an active amateur astronomer and science writer for almost 60 years. He lives in North Vancouver.

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HERCULES

Talk about a hard-luck story! The tale of woe surrounding the Greek hero Hercules is tough to beat.

by Ken Hewitt-White

HERCULES' FATHER was Zeus, king of the gods and a real ladies' man. Breaking his wedding vows to the goddess Hera, Zeus descended to Earth and found himself a mortal missus. The product of this union was Hercules, a human boy of enormous strength and courage—and the instant target of Hera's jealousy.

The vengeful Hera placed two huge snakes in the infant's crib, but Hercules easily crushed them. Years later, she put Hercules under a brief but devastating spell of insanity, during which he killed his entire mortal family. Although this was hardly a premeditated crime, Hercules was advised that his only hope for redemption lay in completing 12 onerous tasks.

Onerous, indeed! Between such unsavoury jobs as mopping the stables of 3,000 cows and stealing a girdle from the Queen of the Amazons, our hero engaged in mortal combat with creatures that had somehow bypassed evolution. A partial checklist tells us that he poisoned man-eating birds and horses, strangled a three-headed dog, sliced and diced a nine-headed water snake and skinned the allegedly invulnerable Leo the lion. The word on Hercules was, love him or hate him—just don't mess with him.

Hercules survived the 12 labours only to be accidentally done in by his second wife. She smothered his clothes with a potion that she believed would ensure his fidelity, but in fact, it turned out to be a flesh-eating toxin. Hercules had finally had enough, and he pleaded with his father for asylum in the heavens.

Today, skywatchers can admire the fearless warrior any clear summer night. Our chart depicts him kneeling with one foot planted daringly on the head of Draco the dragon. The mythical muscleman wears his hard-won lion skin and brandishes a heavy club. An upraised arm is marked by 2.8-magnitude beta Herculis, or Kornephoros ("club-bearer"). His head is symbolized by alpha Herculis, a red sun that fluctuates between magnitude 2.7 and 4.0. Named Rasalgethi ("kneeler's head"), this unspectacular alpha star suggests that hunky Hercules was brave, but none too bright.

As viewed from Canada, Hercules strikes his gallant pose upside down. However, that orientation turns a "Herculean" asterism called the Keystone right side up. Anatomically, this smallish quadrilateral of four third- and fourth-magnitude stars outlines the kneeler's lower torso, but for many stargazers, the Keystone is Hercules, pure and simple. ✦

by Ken Hewitt-White

Stargazing in Its Purest Form

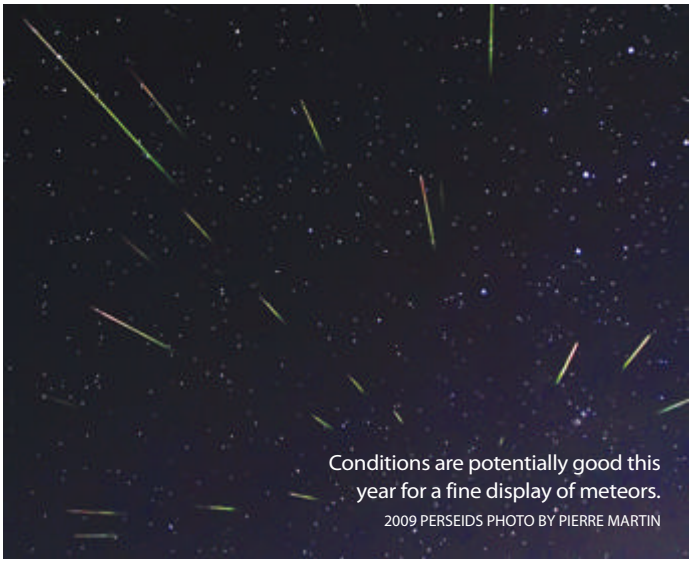
Star partiers (and worriers), take note: The Perseids are coming!

WEDNESDAY, August 12, is Perseid night, and I'm getting nervous. Looking ahead to the year's marquee meteor shower, my worry is whether our weather will work wonders on the Wednesday. I'm tense, troubled and tongue-tied too.

Meteorological concerns aside, a watchable Perseid shower depends on two key astronomical circumstances. Of primary importance is the whereabouts of the Moon. Last summer, a full Moon washed out a lot of meteors on the big night. This year, as Alan Dyer explains in greater detail on page 32, the Moon is new on August 14, so moonlight won't be an issue.

We also want to know when Earth will reach the centre of the meteor stream. The centre is where the action is, and in 2015, the period of maximum activity favours us in North America. According to the RASC *Observer's Handbook*, the peak should occur during the predawn hours of August 13 for observers across the eastern half of our continent. That's good, because after midnight, the Perseid radiant point climbs highest in the sky. In my Pacific time zone, the shower might strike with somewhat less impact soon after nightfall on August 12, when the radiant is lower. Notice the qualifiers "should," "might" and "somewhat." Part of the fun of meteor watching is not knowing exactly what will happen.

My interest in this stuff goes back five decades. I was a green but keen amateur astronomer in 1967 when I joined a meteor observation group in the Ottawa Centre RASC. At the club's rural observatory that summer, I quickly learned how to identify Perseids, reliably estimate their brightnesses, log them in 10-minute intervals (as many as 30 per night), then graph the results to reveal some basic physical characteristics of the shower. The 1967 Perseids were expected to peak on the afternoon of August 12, so we had hoped to record impressive numbers across two nights. The night of August 11/12 was cloudy (drat!), but August 12/13 was clear. Our eight-person team logged over 2,200 sightings of 1,808 meteors—a good haul despite the Moon's not setting until almost midnight. Keener Ken was absolutely thrilled.



Conditions are potentially good this year for a fine display of meteors.
2009 PERSEIDS PHOTO BY PIERRE MARTIN

I still get revved up for the Perseids. That the coming show roughly coincides with a new Moon is doubly fine, because star parties across the land align themselves with the dark of the Moon. The longer-duration events—those spanning a week or so—are promoting the Wednesday-night meteor spectacle as a can't-miss celestial attraction. I'm all for it. My Perseid strategy involves being under a dark sky at the annual Mt. Kobau Star Party, in British Columbia, slated for August 8 to 16. I'm delighted that my favourite meteor shower will crest in the middle of my favourite star party. That makes two reasons to worry about the weather!

I usually spend my dark hours on Mt. Kobau deep-sky observing with my Dobsonian telescope. But if the outlook is favourable at nightfall on August 12 (or even the night before), I'll shift from scoping the heavens for faint fuzzies to scanning the sky for shooting stars. There's more to this than just counting meteors. I occasionally crave the wide canvas, the whole starry vault, with no optical gear between my eyes and the stars. A lengthy Perseid vigil satisfies that craving. In my view, meteor-watching is stargazing in its purest form.

Try it yourself. I suggest you lie back and face south, *away* from the Perseid radiant. I say this for two reasons. First, bright Perseids far from the radiant produce the longest streaks. Second, the Milky Way in the south is incredible. In between sightings of meteoric daggers slicing across the starscape, you can concentrate on that scintillating portion of the Milky Way stretching from Sagittarius to Cygnus. Soaking up starlight relaxes the body and releases the mind. Imagine spiral arms, myriad suns, exotic planets, and think: You're a sentient being alive in a galaxy. There might not be anything remotely like you out there.

Wherever you are this August, may your sky be clear, dark and full of falling stars. Try to muse a little between meteor sightings. Feel that cosmic awareness. And, above all, don't worry. ✦

Meteor maven Ken Hewitt-White has worriedly met SkyNews *deadlines since our first issue in 1995.*

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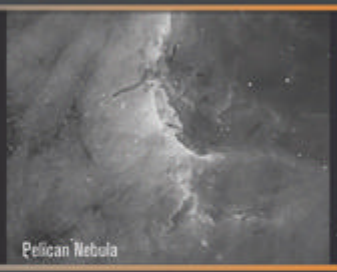
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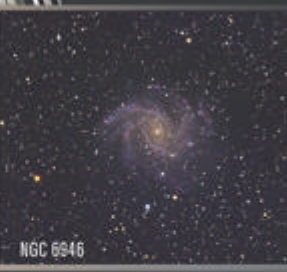
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